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Compressed Air Magazine

WIDE WORLD PHOTO

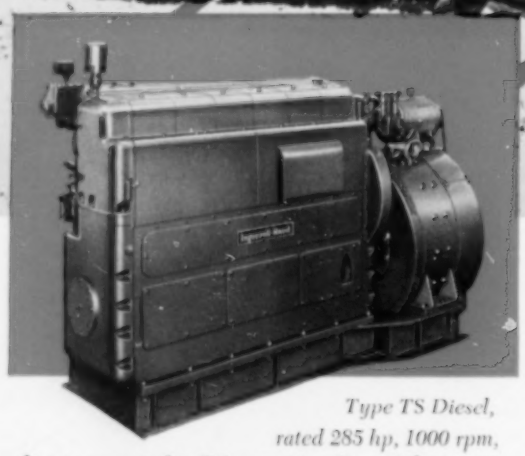
DUMMY TANK TO CONFUSE ENEMY

British Home Guardsmen tote inflated weapon designed to fool attacking foe

(See index page)

VOLUME 59 • NUMBER 11 NEW YORK • LONDON

I-R DIESELS solve tough ore-hauling problem at open-pit mine



Type TS Diesel, rated 285 hp, 1000 rpm, direct connected to DC generator. Two of these units are installed in each of the ore-hauling locomotives.

Dieselization of "outgrown" battery power enables electric locomotives to keep pace with expanding mining operations.

At this huge open-pit copper mine, all ore-hauling locomotives operated originally on both storage batteries and overhead DC power. The batteries were used at the benches, where overhead lines were impractical and the power line was utilized for the run from mine to the crusher. This worked out fine until 1950. By that time the benches had been so extended that the batteries weren't able to complete the run. Larger batteries were impractical and the problem was referred to the locomotive manufacturer.

The answer—Ingersoll-Rand Type TS Diesels! Thirty-four 285-hp diesel generator units were used—two installed in each of the locomotives. Now bench length is no problem at all. And the DC power line can still be used for the long run to the crusher.

This is typical of the many applications where Ingersoll-Rand diesel engines are being profitably applied. Their dependability and economy in heavy-duty service are a matter of record. Available in sizes from 200 to 1000 hp. Ask your Ingersoll-Rand representative or branch office for complete details.

Ingersoll-Rand

7-118 11 Broadway, New York 4, N. Y.

Pumps • Compressors • Vacuum Equipment • Turbo Blowers • Rock Drills • Gas & Diesel Engines • Air & Electric Tools

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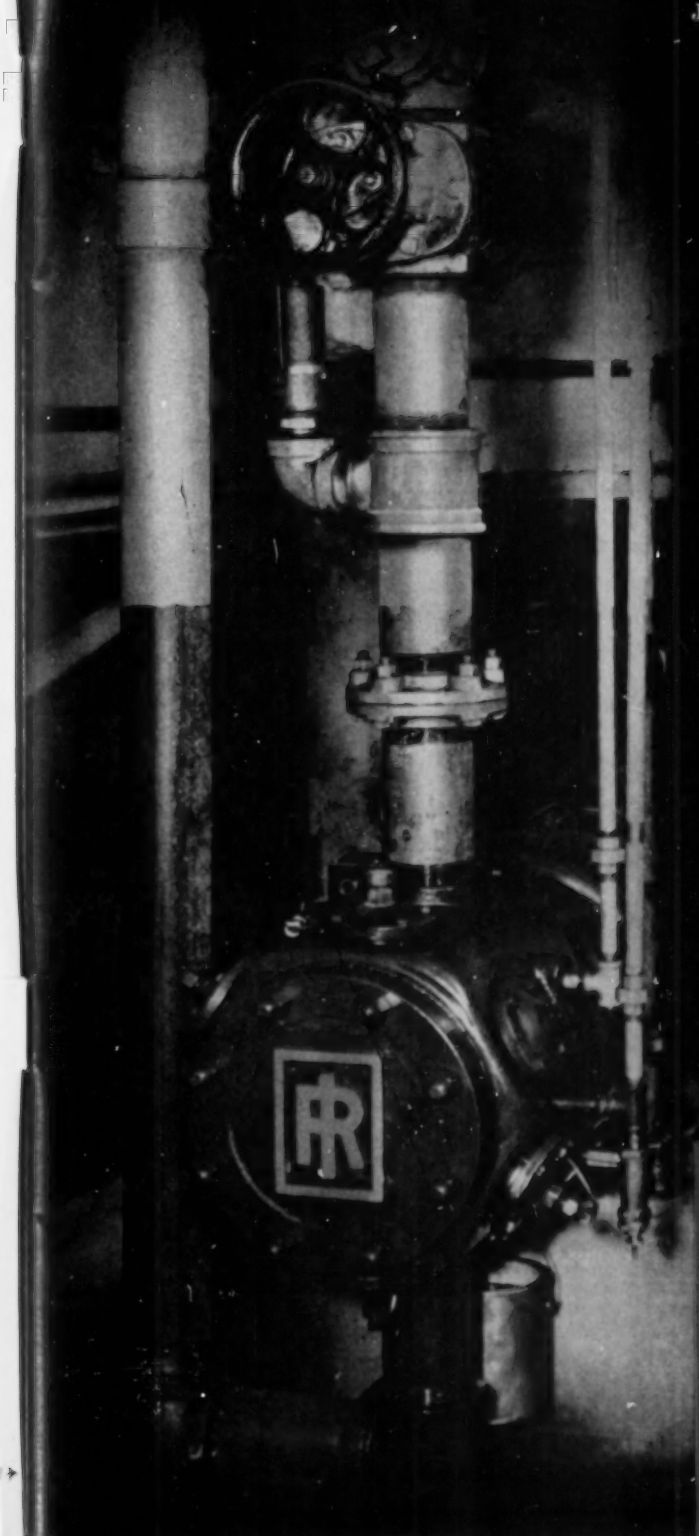
STAYNEW INTAKE FILTERS PROVIDE

Positive Protection

AT VICTOR INSULATORS, INC.

"INSTALLED IN 1947, THIS COMPRESSOR HAS OPERATED DAY IN AND DAY OUT WITHOUT MAJOR REPAIRS OR OVERHAUL."

Jim McKee, Maintenance Department Foreman



Pictured is Staynew Intake Filter installed on roof above compressor at Victor Insulators, Inc., Victor, New York.

EVEN under severe service conditions . . . air heavily laden with abrasive clay dust . . . a Staynew G-3 Intake Filter effectively guards this vital compressor. The Staynew Intake Filter actually operated at peak performance *two years* without attention. That's POSITIVE PROTECTION! An amazing record . . . duplicating those set by Staynew Intake Filters throughout all industry.

Your equipment needs this protection, too.
Write today for all the facts in Bulletin S.I.F.

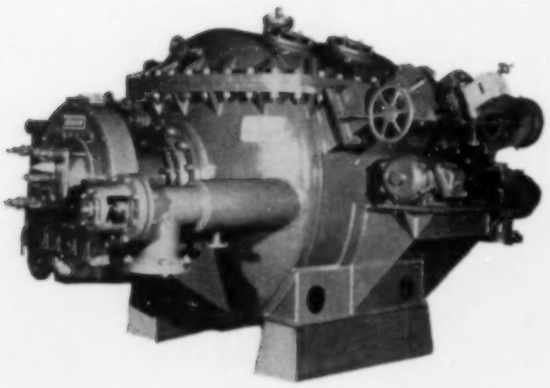
Representatives in Principal Cities

DOLLINGER STAYNEW FILTERS

DOLLINGER CORPORATION

7 Centre Park, Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED



Price or Performance?

When you have a place for a filter in your flow sheet and the function of this particular step is important, your purchasing should be done on the basis of performance and not price.

If you buy on the basis of performance, with specifications and design guaranteed to meet the performance, your first choice will be an Eimco.

If your work, however, can be satisfied with so many square feet of filter area and your first consideration is price, there are many able to supply your needs.

Eimcos are not cheap because they have built into them the heavy construction, the precision design and the unique know-how that comes with more than half a century of successful experience.

Eimco will devote to your filtration problem, be it vacuum or pressure, the skill of its trained engineers in research, testing, design and construction. It will then guarantee successful results duplicating the test work necessary to prove your flow sheet.

Does your process need the best? If it does and you are willing to look beyond first cost, it will pay you to have Eimcos at the start.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Texas Birmingham, Ala. Duluth, Minn. Kellogg, Ida. London, Eng. Paris, France Milan, Italy

B-75

You Can't Beat An Eimco!

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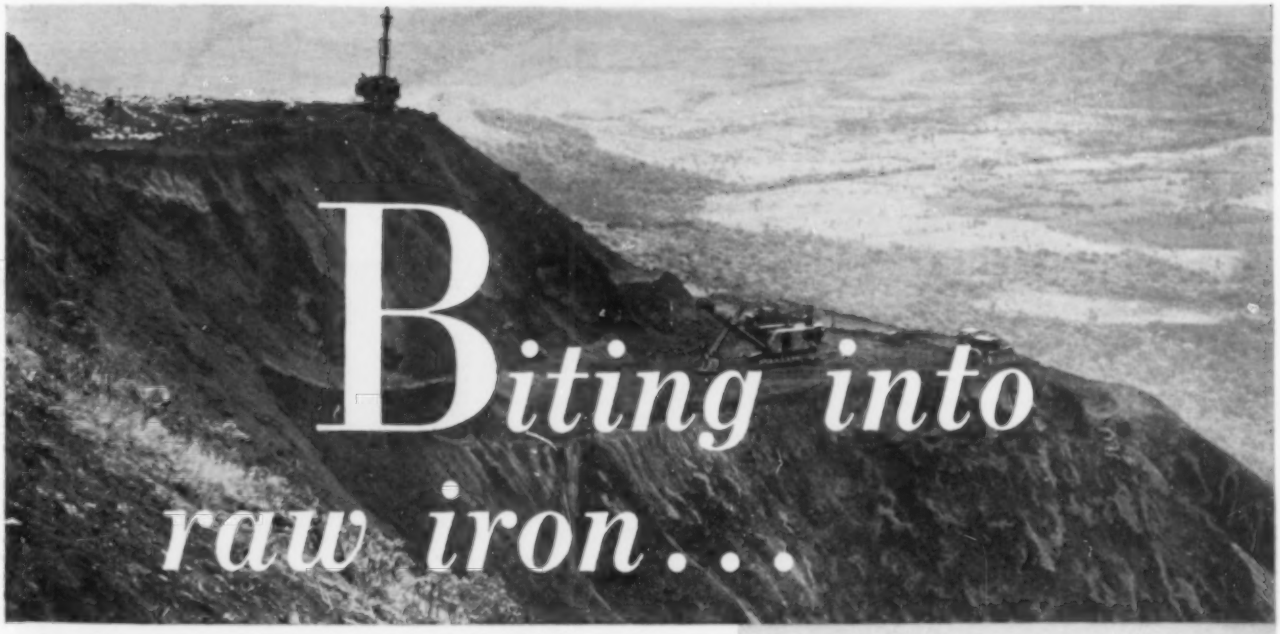


Biting into raw iron...

Two years of tough, schedule-smashing construction by the men of Morrison-Knudsen Company made possible the first shipment of ore from Venezuela's Cerro Bolivar, for the United States Steel Corporation.

To reach the ore deposits, a 91-mile railroad and an 80-mile highway had to be constructed. A monthly average of 400,000 cubic yards of earth and rock was moved to prepare the railway grade alone. Part of the way, excavation was almost entirely in double-extra-hard granite, with a crushing strength of 60,000 psi. And on the southern slope of Cerro Bolivar itself, scores of side-hill cuts were made through hard layers of solid ore that graded 65% or more pure metal.

This was a job that demanded an exceptional combination of engineering skill, determination, and the best of construction and drilling equipment... that's why Crucible Hollow Drill Rods were chosen. For *lowest cost per foot of hole drilled* specify Crucible Hollow Drill Rods.

Crucible Hollow Drill Steel in machines like these bite into ore on Cerro Bolivar.

One of the men who helped make the project possible — C. Dugan Graham, vice-president of M-K de Venezuela, and project manager in charge of the job.

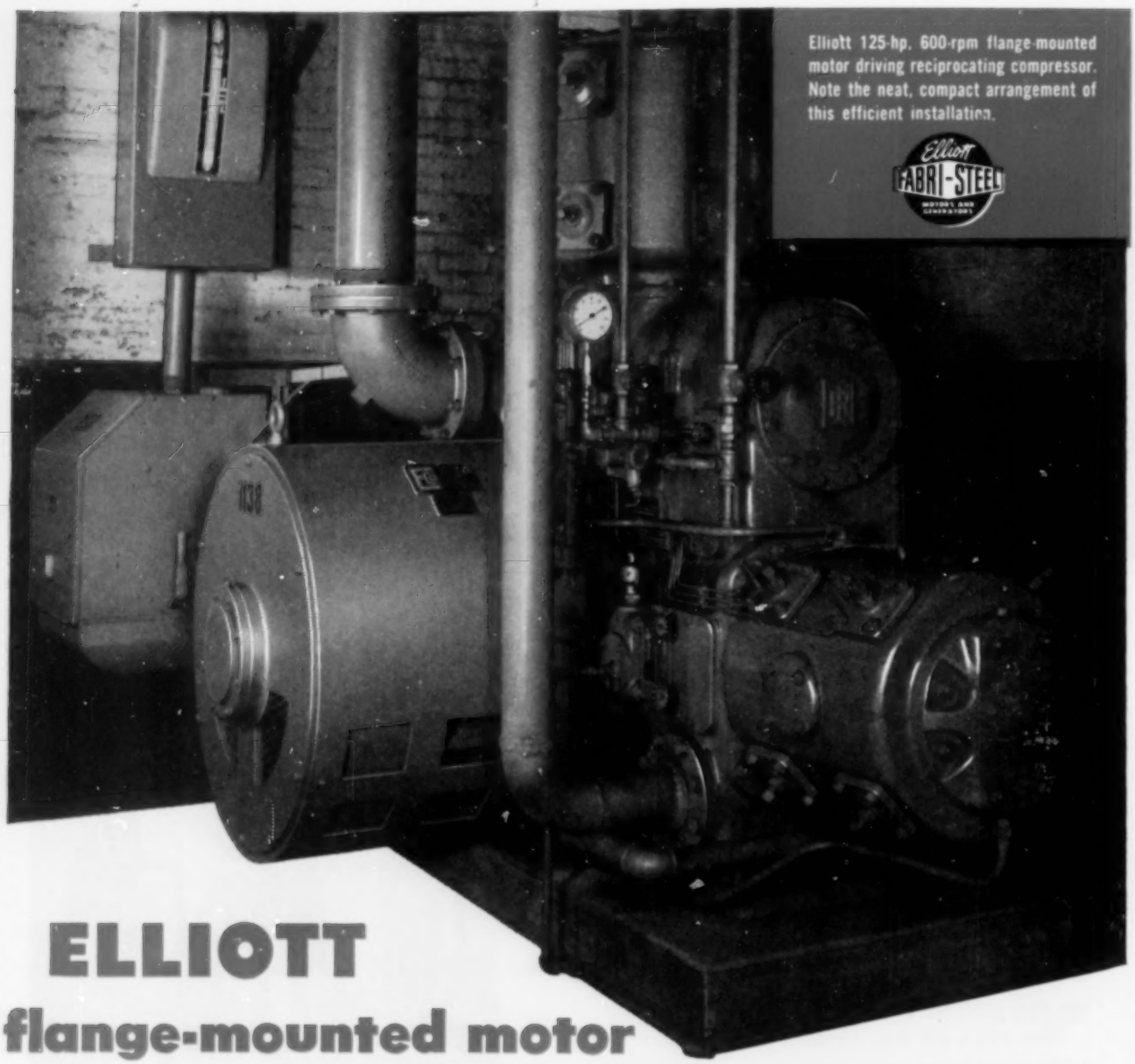
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

HOLLOW DRILL ROD

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • MAX-EL • ALLOY • SPECIAL PURPOSE STEELS



Elliott 125-hp, 600-rpm flange-mounted motor driving reciprocating compressor. Note the neat, compact arrangement of this efficient installation.

Elliott FABRI-STEEL MOTORS AND GENERATORS

ELLIOTT
flange-mounted motor for reciprocating compressors

COMPACTNESS AND ECONOMY of installation makes this motor-driven compressor unit a neat "package" on any floor. The Elliott motor, a vital element in this unit, requires a minimum of space with the motor stator mounted on a flange bracket on the side of the compressor frame and the motor rotor mounted directly on an extension of the compressor shaft. Elliott motors are available for this type of installation as squirrel-cage induction motors and either unity powerfactor or .8 PF leading synchronous motors in ratings of 125 and 150 hp at 600 rpm and 200 and 250 hp at 514 rpm.

Excellent design and careful workmanship make this Elliott motor a worthy teammate for your compressor. Insulation, the key to long motor life, is given very special attention. The finest materials are selected, and they are applied by experienced craftsmen. In addition, Elliott will supply any make of control requested and *provide a completely coordinated motor, control and exciter combination.* For complete technical details, write Elliott Company, Ridgway Division, Ridgway, Pa.

ELLIOTT Company

R4-16

TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

Checking the accuracy of fit inside of cylinder. Checker illustrates comparative size of the three 80-inch Koppers Piston Rings required per cylinder. Photo courtesy of S. Morgan Smith Co.

80-inch KOPPERS Piston Rings for McNary Dam Project

In all, 42 such rings will be incorporated in the McNary Dam installation equipment.

S. Morgan Smith Company is installing these tremendous Koppers Piston Rings in Smith-Kaplan blade servomotor cylinders. When fitted with pistons and integrated with the hydro-electric turbine shaft, these units will automatically control the runner blade pitch in proper ratio with the turbine assembly wicket gate openings. These servomotors will operate under a pressure of 350 PSI.

Yes, these are unusually large Koppers Piston Rings. But it is not unusual for Koppers to tackle such piston ring problems. Koppers engineers are so widely experienced and manufacturing facilities are so extensive that Koppers can fill the most difficult of piston ring requirements.

Next time you are concerned with piston rings or sealing rings, whether in replacement or new installations . . . in engines, large or small . . . or if you have a special problem . . . call on Koppers. We are always ready to help you.

Never any obligation, of course. Also, mail coupon for more information.

KOPPERS

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • Baltimore, Maryland

This Koppers Division also supplies industry with Fast's Couplings, Aeromaster Fans, Koppers Electrostatic Precipitators and Gas Apparatus.

Engineered Products Sold with *Service*

AMERICAN HAMMERED *Industrial Piston Rings*

KOPPERS COMPANY, INC., *Piston Ring Dept.*, 1611 Hamburg Street, Baltimore 3, Md.

Gentlemen: Please send me free 16-page booklet containing full information on Piston Rings.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

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FOR THAT EXTRA MARGIN IN SHOVEL PERFORMANCE...

WARD LEONARD ELECTRIC EXCAVATORS

MORE OUTPUT even under the toughest conditions . . . more loads per shift in any quarry or mine . . . extra loads for that EXTRA MARGIN in performance . . . that's what you get from this exclusive combination of shovel front-end features:

1. **TWO-SECTION BOOM** provides maximum strength with minimum weight. The lower section is rigidly connected to the A-frame . . . takes the heavy stresses of the digging cycle in stride because it is part of the main machine.

2. **TUBULAR DIPPER HANDLE** is much lighter than equivalent two-member handle, yet equally strong. Its ability to rotate in the rubber-cushioned saddle block eliminates torsion during the digging stroke, minimizes shock loads.

3. **TWIN DUAL HOIST ROPES** assure a steady, positive digging action with automatic shift of hoist power to that part of the dipper lip where it is needed.

4. **INDEPENDENT ROPE CROWD** is simple, positive and quiet. Shipper shaft pinions and handle racking are eliminated. Crowd machinery is located on main deck rather than on boom — swing inertia is reduced, the operating cycle speeded up.

5. **QUICK CONVERTIBILITY** to dragline of the independent motor type. Hoist and drag functions are powered by separate motors, eliminating operating clutches and brakes. 5154

These features — plus many more — make Bucyrus-Eries the finest heavy-duty excavators ever built: yard for yard, dollar for dollar, pound for pound. Write today for complete information on the 4½-yd. 110-B, the 6-yd. 150-B, or the 8-yd. 190-B.

Bucyrus-Erie Company

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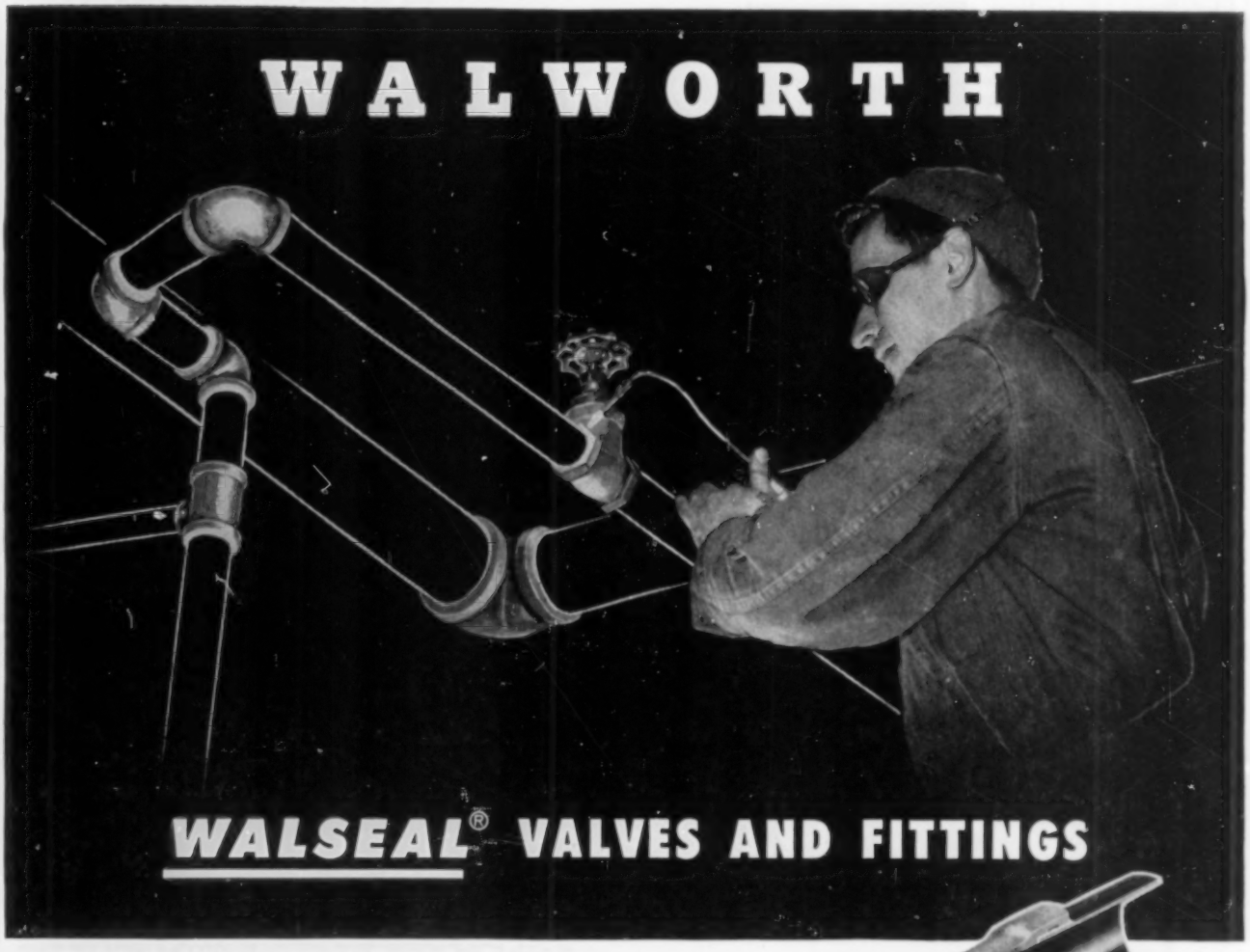
WALWORTH



WALSEAL® VALVES AND FITTINGS

Cutaway view of a Walseal Tee showing: factory-inserted ring of silver brazing alloy; fillet of silver brazing alloy that appears upon completion of Walseal joint; cutaway view of the completed joint showing that silver brazing alloy has flowed in both directions from the factory-inserted ring.

Better because . . . **There's no guesswork when a silver-brazed joint is made with a Walseal fitting. Sil-Fos alloy, which appears as a fillet at the face of a Walseal joint, comes from rings which have been factory-inserted in the end connections of Walseal fittings. The bright silver alloy fillet that you can see assures full penetration of alloy for a permanently leakproof joint.**

Walseal is a registered trade mark which identifies valves and fittings manufactured by the Walworth Company. Walseal products have factory-inserted rings of silver brazing alloy in threadless ports. Walseal joints can be made only with Walseal valves and fittings.

If you're piping water, oil, steam, air, oxygen, nitrogen, helium or other industrial gases or refrigerants through brass, copper, or copper-nickel pipe, you'll want to investigate Walseal — available in complete lines of valves and fittings in four distinct pressure ranges — from 0 to 5000 psi. working pressure*. Your copy of Circular 115 will be sent on request . . . see your near-by Walworth Distributor today, or write to: Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

*Walseal fittings and valves are being used at sub-zero temperatures as low as —350 F.

Make it "a one-piece pipeline" with WALSEAL

SEE OUR CATALOG IN SWEET'S

WALWORTH

Manufacturers since 1842

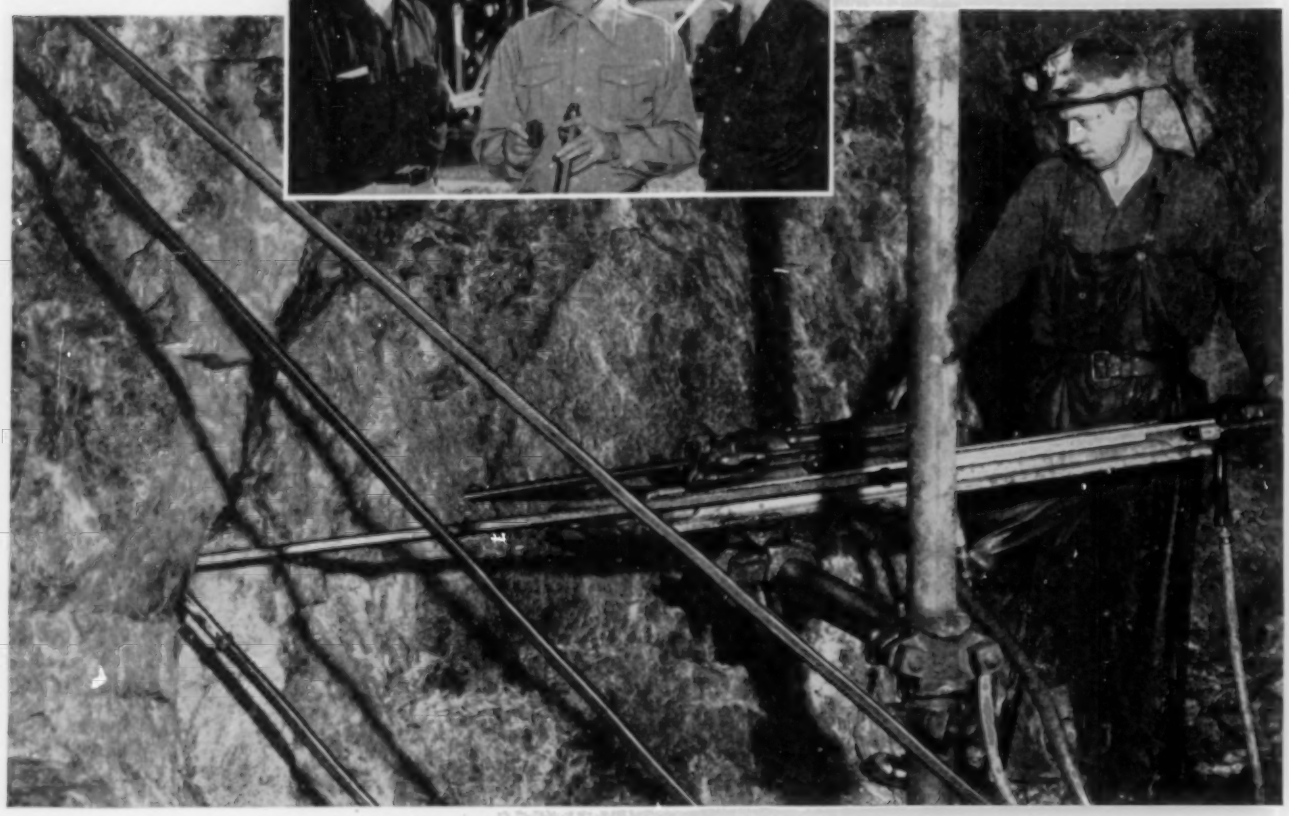
valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

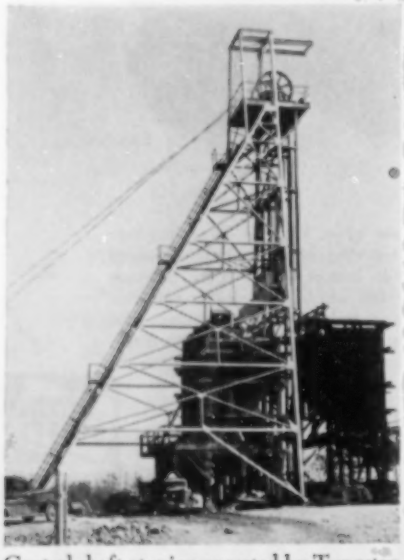
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Clyde Patton, sales engineer, of Brunner & Lay Rock Bit, chats with Benton Bailey, assistant to general manager, and Elmer Roberts, foreman, Tungsten Mining.

Bethlehem Hollow Drill Steel bites into a quartz vein on the 700-ft level. The 1-in. hexagon alloy drill steel is fitted with carbide bits. Both were furnished by Brunner & Lay Rock Bit Corporation, Asheville, N. C.



North Carolina Mine Yields Huebnerite Tungsten Ore



Central shaft at mine operated by Tungsten Mining Corporation, Henderson, N. C., extends to depth of 1600 ft. Steel headframe is 72 ft high.

A good grade of tungsten ore, huebnerite-quartz, is being mined in, of all places, North Carolina. The underground mine, hundreds of miles from other commercial tungsten deposits, is located in rolling country north of Henderson. It is operated by Tungsten Mining Corporation, of Henderson, and is producing in the neighborhood of 800 tons per day.

The operators are using a modified system of square-set stoping, and are hoisting the strategic ore from two shafts, each 1600 ft deep. The huebnerite is found in quartz veins, with sericitic-schist walls. The country rock is a hard granite-gneiss. Drilling conditions vary, and include very hard, medium-hard, and abrasive formations.

Drilling is being done by means of jackhammers, stopers and drifters. Blast holes are 6 ft to 11 ft deep. An alloy type of Bethlehem Hollow Drill Steel, 1 in. hexagon and fitted with carbide-insert bits, is being used exclusively. The operators report that it is giving excellent service.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Two Grades of BETHLEHEM HOLLOW DRILL STEEL

CARBON • ULTRA-ALLOY (chrome-moly)

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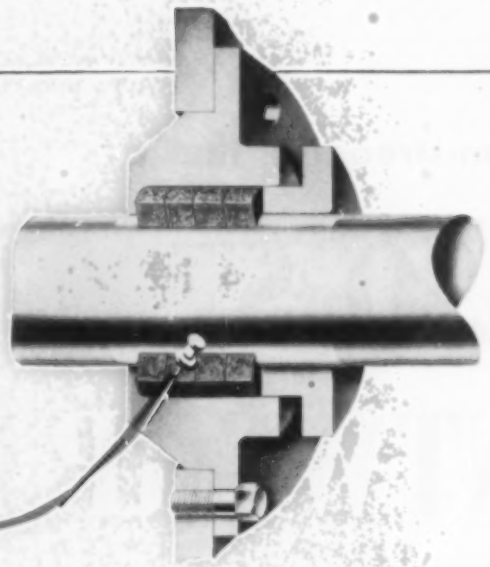
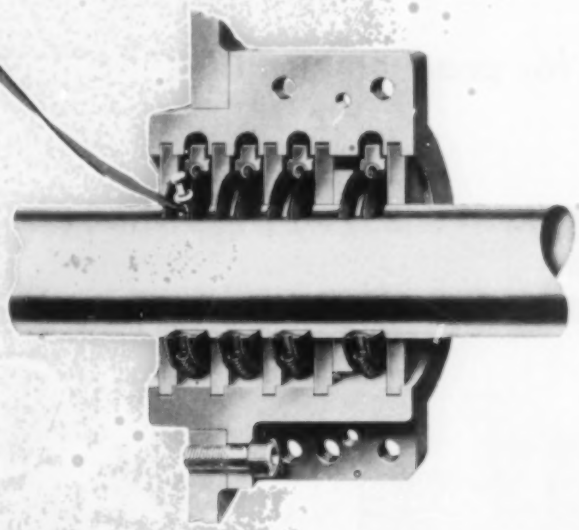
COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORPORATION
211 Park Avenue
Worcester 2, Mass.
Sales offices in
THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

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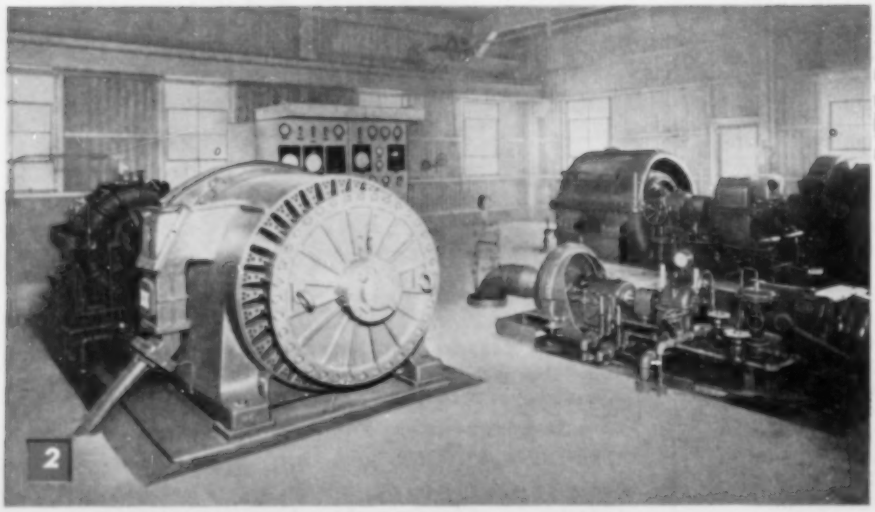
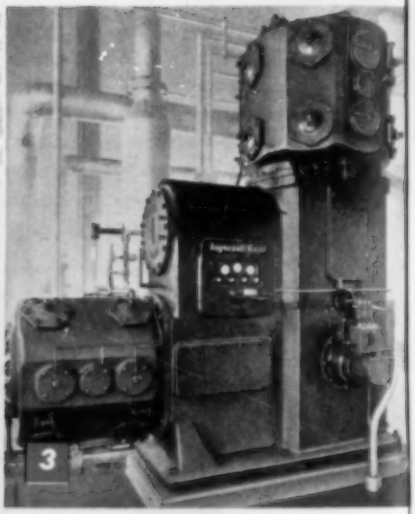
on stream at the

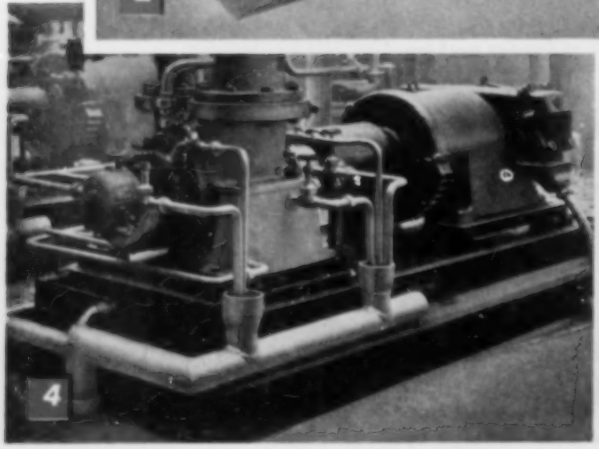
ESSO STANDARD ANTWERP REFINERY

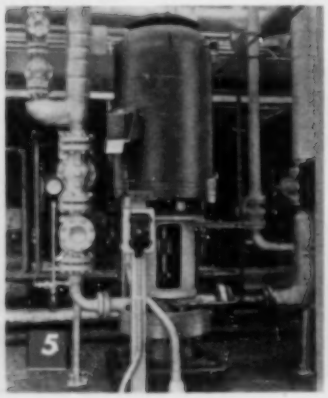
69 I-R PUMPS

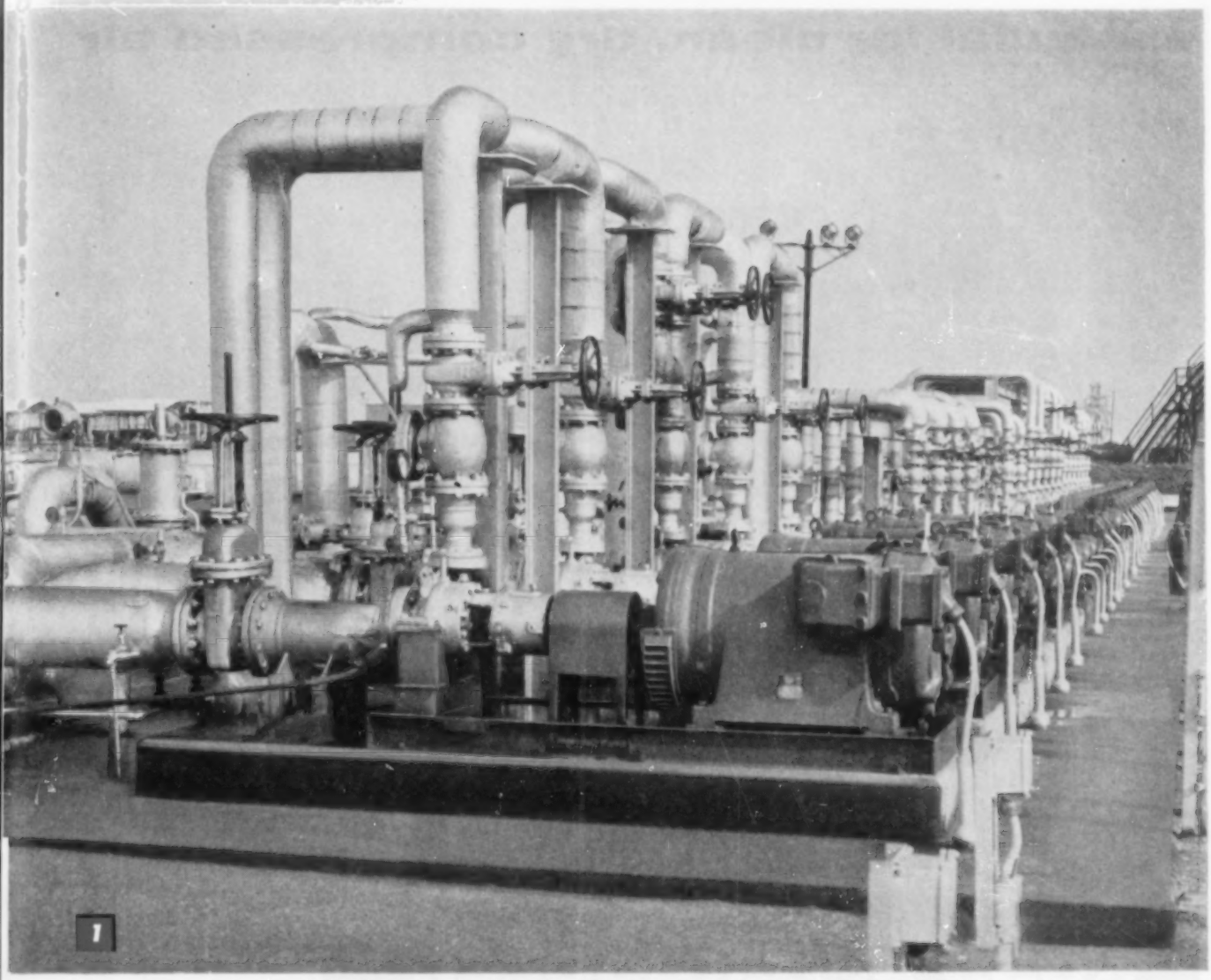
for practically all liquid-moving services











1

. . . plus I-R Cat Cracking Blowers and Compressors for dependable plant and process air

1. Line-up of 27 Ingersoll-Rand centrifugal process pumps at the loading plant of Esso's Antwerp, Belgium, refinery.
2. Three I-R Turbo-Blowers serving the Model IV cat cracking unit. The two large blowers handle air and gas respectively and the small, single-stage unit in the center provides control air for the regenerating process.
3. Electric motor-driven Ingersoll-Rand Class XLE compressor supplying plant air. A similar compressor is turbine-driven.
4. An I-R two-stage, heavy-duty process pump at Antwerp.
5. An Ingersoll-Rand 20-stage vertical process pump, Class VHTB, handling heavy naptha for the charging furnace.
6. Two I-R vertical process pumps, Class VP, handling kerosene in the SO_2 plant.

HERE AT Belgium's newest petroleum processing plant, *economy* is the keynote. A new, simplified processing technique, perfected by Standard Oil Development Company, has cut overall refinery cost at least 20%. And the resulting savings in operating and upkeep costs make this one of the most economical plants ever built. In production since July 1953, the plant processes 25,000 bbl per day of middle Eastern crude, for gasoline, kerosene, diesel oil and light and heavy fuel oils.

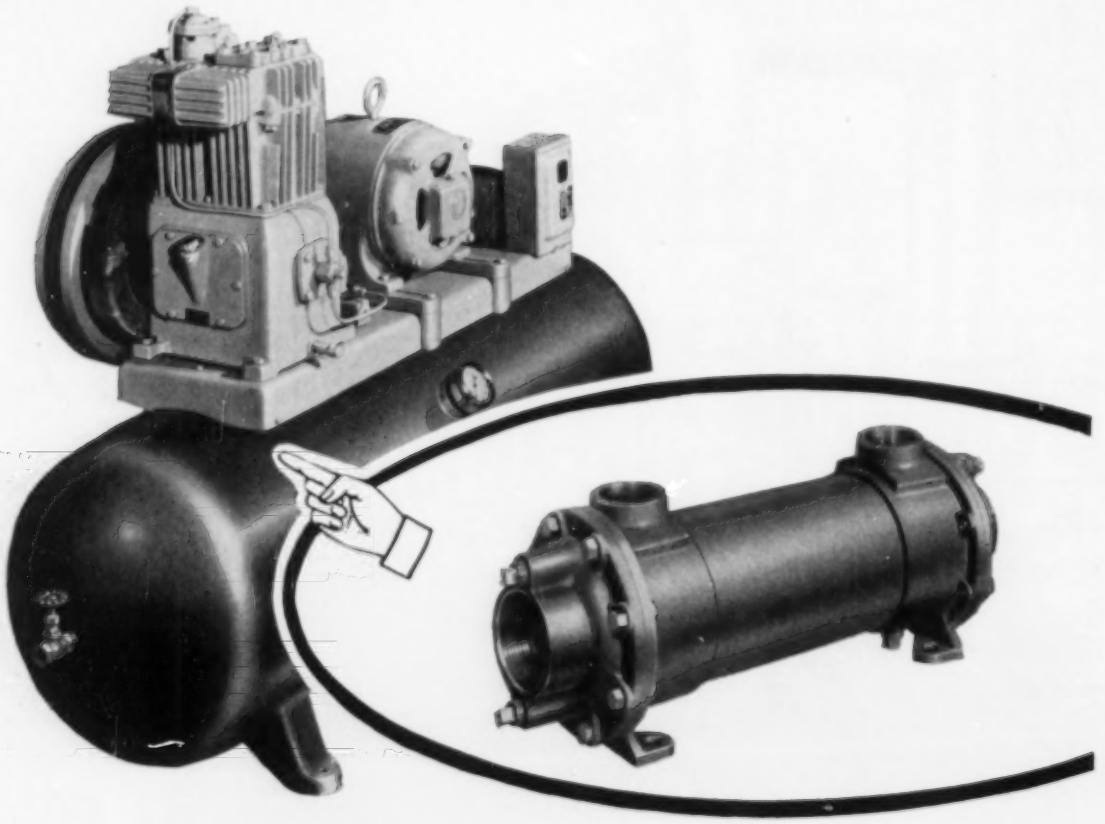
The Ingersoll-Rand equipment shown in the accompanying photographs is another example of the long-range economy of this 225-acre plant. For I-R pumps, blowers and compressors are known the world over for efficient performance and *lasting dependability*. Your I-R representative or branch office will be glad to give you complete information on any of this equipment.

Ingersoll-Rand

11 Broadway, New York, N. Y. 14-74

COMPRESSORS • TURBO-BLOWERS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • VACUUM EQUIPMENT

essential for clean, dry compressed air



ROSS AFTERCOOLER

Whenever compressed air is used for paint spraying, operating air tools or removing chips and dust from metalworking machines, *the air must naturally be clean and dry*. That's why dependable Ross Aftercoolers are important accessories on so many makes of compressors.

The tank-mounted compressor shown above is typical. When required, a Ross Aftercooler is recommended and installed by the compressor manufacturer. Its compactness enables convenient location on the upper side of the air receiver, alongside the motor-compressor base.

Because of their ruggedness and heat exchange efficiency, Ross Aftercoolers are widely preferred by compressor builders and users alike. The same holds true for Ross Intercoolers and Lube Oil Coolers. All three are available in a wide range of fully standardized designs to fulfill most requirements without delay.

Make sure your organization is acquainted with these essential compressor components and accessories. Detailed information will be mailed promptly on request. Write.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1471 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

ROSS®

INTERCOOLERS
AFTERCOOLERS
LUBE OIL COOLERS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

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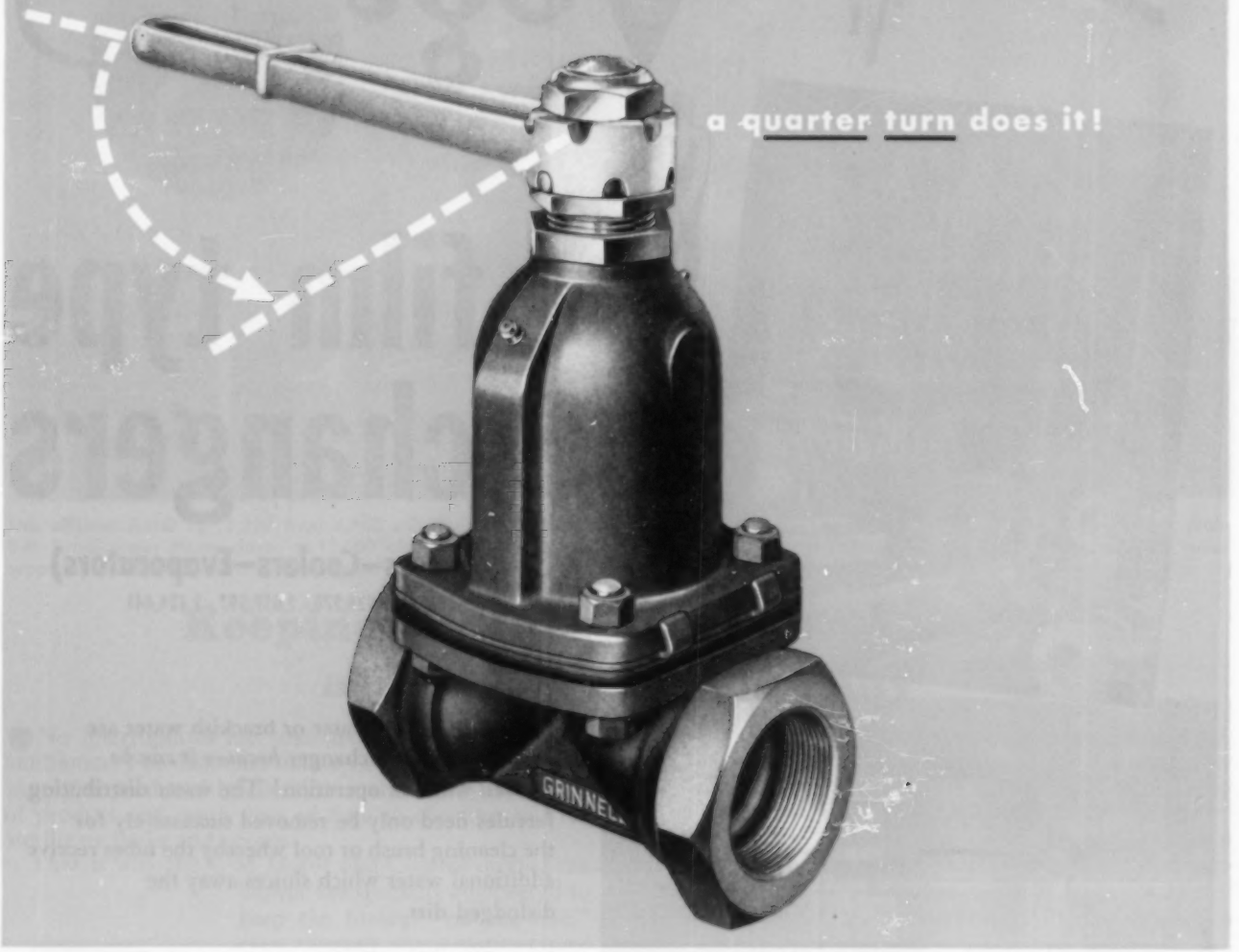
Newest...and Fastest in Compressed Air Control Valves



Only *one quarter turn* of the control lever is needed to close or open the new QUICK-ACTING Grinnell-Saunders Diaphragm Valve. The lever actuates a shaped cam that lowers or raises the valve stem smoothly and with relatively little effort. Easy operation is secured by careful design of the cam surfaces, to apply increasing force as the resistance to closure increases.

In the smaller sizes, this new valve is ideal for air-operated tools, presses, clamps, molds, or wherever fast control is requisite. In the larger sizes it supplies quick control of air agitators, or large headers at compressors where speed may be a factor in safety.

All of the established and outstanding features of Grinnell-Saunders Diaphragm Valves are retained: complete isolation of all working parts, leak-proof closure, a high lift for full streamline flow, freedom from clogging, a choice of diaphragm materials resistant to oil and to most chemicals, body linings to suit the required service, and easy maintenance. Write for full details *today*.

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

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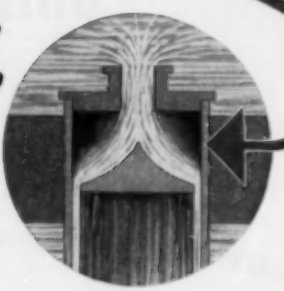
Dirty Water can't "Shut-down"...

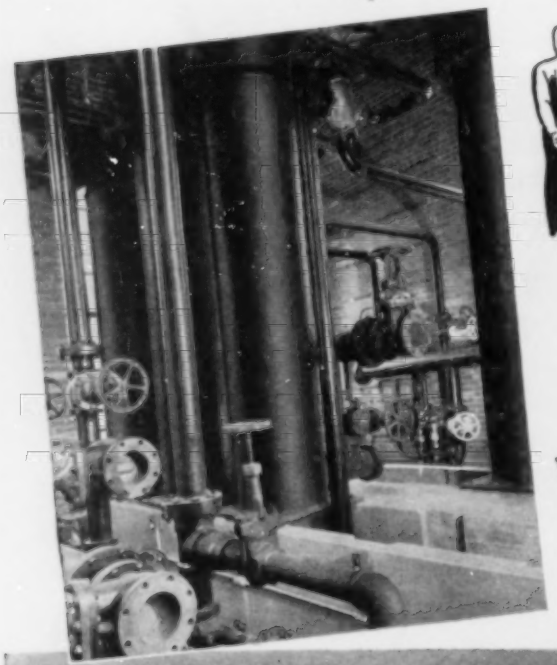
Vogt

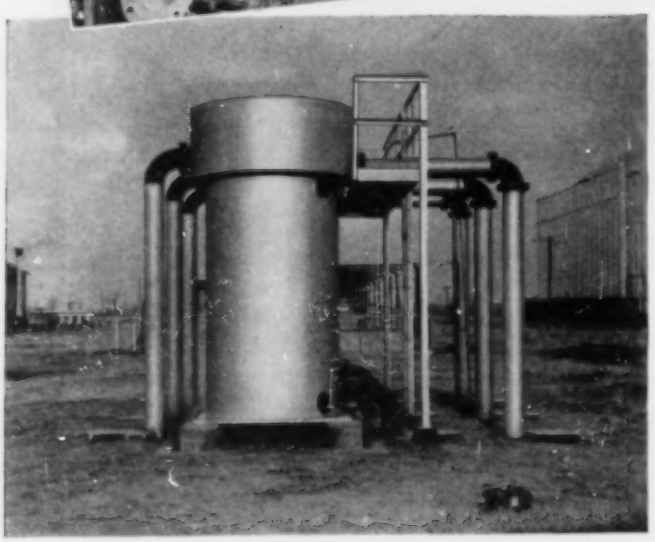


film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441





River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

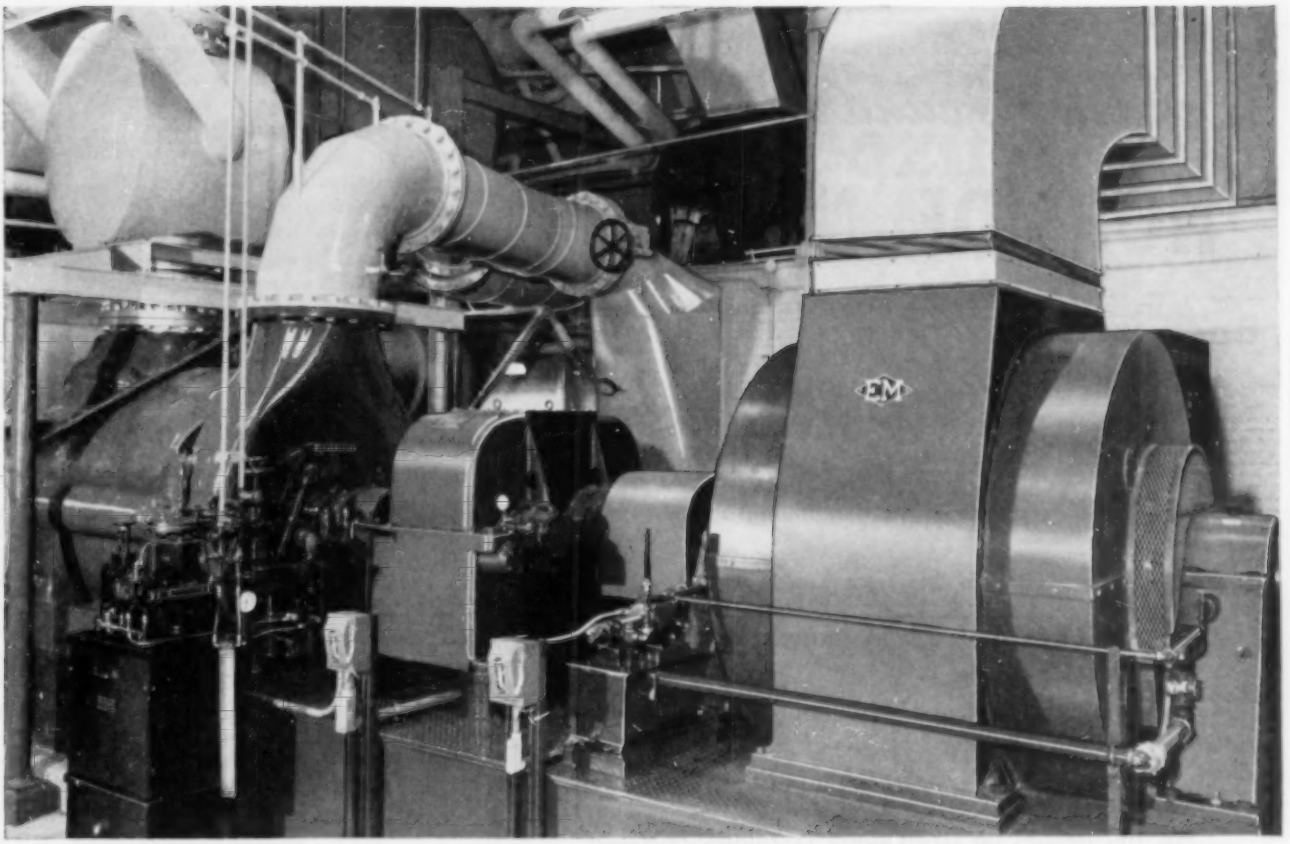
TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request.]

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.



This efficient 2,000 hp, 1,200 rpm, 4,160 volt, 0.8 power factor E-M Synchronous Motor drives a 15,000 cfm centrifugal blower supplying air for fermentation process at Eli Lilly and Company, Indianapolis, Indiana. The Motor's "brain" is an E-M Hi-Fuse, High-Interrupting Capacity Control, closely co-ordinated with the Motor to insure continuous operation.

Keeping a vital blower "*on the line*" at Eli Lilly and Company

● No interruptions are tolerated in the processing of antibiotics! For example, failure of the fermentation air supply as produced by the blower above may mean loss of product and costly loss of time in cleaning and re-sterilizing tanks and vessels.

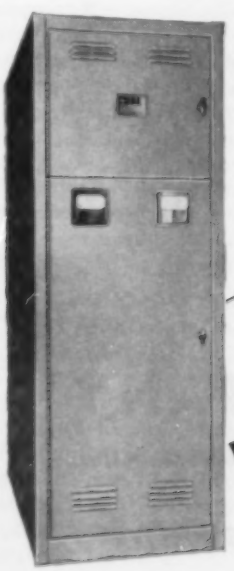
That is why the E-M Motor and Control driving the blower are specially engineered to keep the blower "on the line," *even through momentary voltage dips and line disturbances.*

When voltage drops momentarily, E-M time delay undervoltage protection goes into action. Through d-c operated contactors, the Motor remains connected to the line and "rides out" the dip. The Motor then re-synchronizes when voltage is restored. If the dip is short in duration, the Motor will even *stay* in synchronism. The matched team of E-M Motor and Control insures continuous operation.

Other protective features of the E-M Hi-Fuse Control that help give *complete* protection to Motor and personnel are:

1. Replaceable current-limiting fuses for high-magnitude short-circuit protection.
2. Precisely engineered overload and undervoltage relays.
3. Simple, exact, "conscious" Polarized Field Frequency starting method, developed by E-M.
4. Metal-enclosed cabinet with segregated high and low voltage compartments.

When you plan your next large motor-control application, call your nearest E-M sales engineer for helpful counsel. And write the factory for Publication No. 192, describing E-M Hi-Fuse Controls.



The E-M Hi-Fuse, High-Interrupting Capacity Control is custom designed from standard components, and completely factory assembled. Single units or attractive group lineups . . . add extra controls at any time.

ELECTRIC MACHINERY MFG. COMPANY
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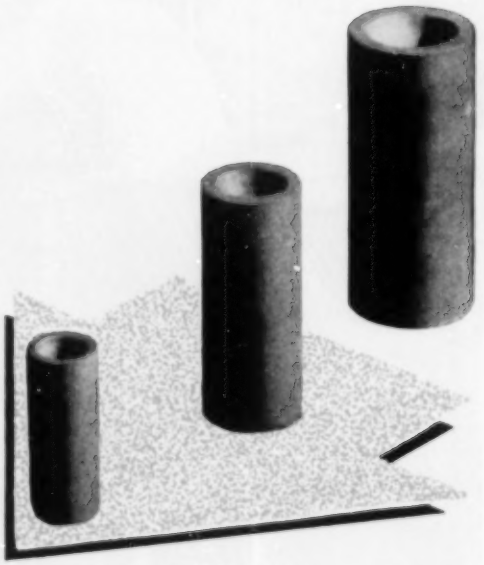

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ON THE COVER

Psychological warfare is taking on increased importance. An army, like a poker player, may get away with a good bluff now and then and it always pays to keep the opposition guessing as to your real strength. With that in mind, the British have developed a lot of make-believe armament—simulated weapons that serve as "window dressing" to delude the foe. Our cover picture shows a group of soldiers carrying an inflated dummy tank during recent maneuvers at Salisbury Plain. Some 12,000 men and 4000 vehicles of Britain's Territorial Army, roughly equivalent to our National Guard, took part in the exercises.

IN THIS ISSUE

A HANDFUL of men sitting at keyboards in towers can break up freight trains and reassemble them into new ones with surprising ease and dispatch in the Bensenville, Ill., classification yard of the Chicago, Milwaukee, St. Paul & Pacific Railroad. Compressed air serves there in two ways: in pneumatic tubes it whisks the make-up schedule of trains to the man who directs the incoming cars to any one of a maze of assembly tracks; and in retarders it puts the squeeze on the wheels of the cars to slow them down as desired. *Push-Button Railroading*, our leading article, gives details.

•

SMALL cylinders charged with compressed gas constitute a convenient form of packaged power for varied services ranging from the carbonation of beverages to the inflation of life rafts. The Hi-Pac Division of the Worcester Pressed Steel Company specializes in making them in a wide range of sizes. Page 313.

•

IT'S more than a joke that many New Yorkers are in the hole much of the time. The vast aggregation of human beings on the eastern side of the Hudson River goes underground whenever it becomes necessary to get around the city in a hurry. Gotham's renowned subway system was opened just 50 years ago. Approximately 10,000 workmen labored more than four years to construct the initial link, a 14-mile nucleus for the present sprawling network. The mechanical rock drill made the huge excavation job economically feasible. Page 317.

•

THE Pilgrims at Plymouth Rock designated a day in 1621 on which to give thanks to the Almighty for their bountiful first harvest. As time passed, Thanksgiving Day became associated with feasting, and as feasting is one of the things the Pennsylvania Dutch do best, November is an appropriate time to print the article, *They Eat Good*. See Page 320.

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A monthly publication devoted to the many fields of endeavor in which compressed air serves useful purposes. Founded in 1896.

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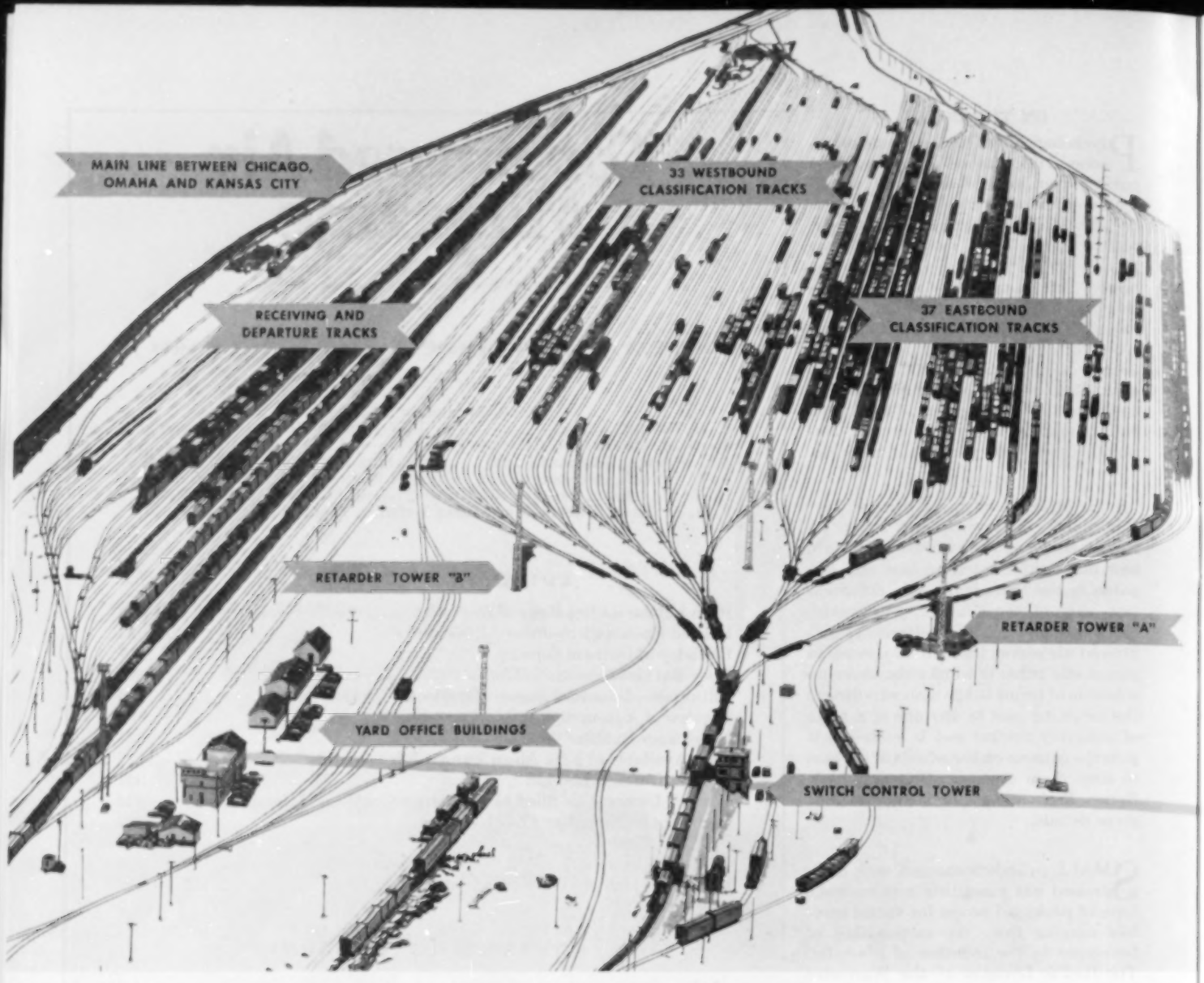

MAIN LINE BETWEEN CHICAGO, OMAHA AND KANSAS CITY
33 WESTBOUND CLASSIFICATION TRACKS
RECEIVING AND DEPARTURE TRACKS
37 EASTBOUND CLASSIFICATION TRACKS
RETARDER TOWER "B"
RETARDER TOWER "A"
YARD OFFICE BUILDINGS
SWITCH CONTROL TOWER

THE BENSENVILLE YARD

Trains arriving at the yard pass over a hump on the track that runs up from the bottom center. The various cars are then directed by the switch foreman in the switch control tower to any one of the 70 classification tracks shown at the top. Air-operated retarders controlled from towers A and B slow down each car just enough so it will reach its destination and there couple onto units that preceded it. The yard can handle 3600 cars per day.

PUSH-BUTTON RAILROADING

Freight cars are classified by electropneumatic devices

J. C. Pierce

SORTING out or classifying freight cars at major junction points is a monumental job for every railroad system. At Bensenville, Ill., 17 miles west of the Chicago loop area, the Chicago, Milwaukee, St. Paul & Pacific Railroad Company—better known as The Milwaukee Road—has transformed its flat switching yard into a 70-track retarder yard boasting the most modern equipment. There cars are classified not only according to the lines that are to receive them but the yards of the individual railways as well.

Completed in mid-November, 1953, it is the world's largest facility of its kind, using both route-switching and retarder-speed control. Designed to classify 3600 cars in a 24-hour day, it has not yet been pushed to capacity but has handled 3256 in that interval. All Milwaukee Road freights to, from and through the Chicago area are switched in this $5½ million yard, which gives patrons better service by handling cars with dispatch; lessening the possibility of damage to contents by exact speed control during shunting operations; appreciably reducing freight-car rentals and switching costs; and decreasing detention time of cars of all common carriers in the region.

Electropneumatic yard switches and retarders aren't new to railroading. They have been used in some major terminals for many years. However, the Bensenville installation represents the latest development in the field. Its 70 tracks, each capable of accommodating from 52 to 102 cars, have an aggregate capacity of 5311 cars. Thirty-seven of the tracks are reserved for eastbound and Terre Haute (south) Division trains, while the remainder are for westbound traffic. In addition to the classification yard there are storage tracks, a stockyard, icehouse facilities, a diesel service house large enough to hold fourteen units, a steam-engine lot, a repair yard and a roundhouse with 28 stalls, bringing the total capacity to 8823 cars.

At Bensenville much is accomplished by few men—specialists who have their fingers on the heartbeat of an intricate electropneumatic system. At a glance out of either the switch- or a retarder-control tower one may see as many as

twenty "cuts" (a car or group of cars cut off a train being classified) moving along on as many tracks at as many rates of speed to be coupled without jarring onto a like number of trains being made up for different destinations. During that survey only one man—the switchman uncoupling cars on the "hump"—may be visible in the entire yard. This is a far cry from the days before remote-control and retarding devices when switches were thrown manually and a brakeman rode each cut to its appointed track.

It was a major operation to convert from a flat yard into a fully automatic gravity switching yard. New tracks had to be laid in a precise pattern and the grade of each one established so nicely as to cause a cut to slow down and come to a halt at any desired point throughout its length. Just ahead of the area where cars enter individual tracks is the hump, about 20 feet high, over which every freight passes for delivery by gravity to any place in the yard. Buildings were constructed; new electric and compressed-air units were set up; transmission and distribution lines were strung; and automatic switching and retarding gear and lighting, signaling and communications systems were installed. All this work was accomplished in less than ten months of elapsed time.

To describe the operation of the yard it is best to follow the movements of a random train made up, let us say, of 135 freights and arriving from the West. In it are cars from Seattle, Spokane, Butte, Aberdeen, Fargo, Rapid City, Duluth and Minneapolis. They are consigned to Chicago, Terre Haute, Indianapolis, Akron, Rochester, New Orleans, Chattanooga, Baltimore, Miami, Detroit, Cleveland, New Haven, Philadelphia and New York. They are at Bensenville for classification and assembly into trains to be routed to the Chicago yards of the different railroads that will send them on their way.

As the string of freights is pulled slowly into the yard, a checker stationed in one of the two inbound-train check buildings adjacent to the incoming tracks at each end of the yard makes a dictaphone record of the number and railroad system initials on each car. This recording is conveyed to an operator in the yard office who prepares from it a typewritten switch list, in triplicate, which is then placed in a carrier and shot through a pneumatic tube to the yardmaster's office in the switch-control tower. From an advance report on the train's makeup the yardmaster obtains the proper track assignments and marks them on the papers, often noting the cars' contents as well and adding special cautionary messages. A copy of this list is delivered by pneumatic tube to the switch foreman in the office below and to each of the retarder operators in their separate towers.

While this is going on, the train rolls onto a receiving track for car inspection. There a yard diesel locomotive takes over, journal boxes are lubricated and the freights are pulled over devices that detect flaws in brake rigging and any obstruction that might interfere with the proper functioning of the retarding equipment. If the hump is clear, the diesel pushes the train over the crest at 2 mph or at a rate of about four cars per minute.

Before we start humping cars, let's consider some variables that have a bearing on efficient and safe classification and that demand a high degree of skill on the part of the retarder operators. Heavy cars roll faster and farther by gravity than light ones. This is also true of those equipped with roller bearings instead of standard friction bearings. In summer, when lubricating oil is warm, cars travel faster than in winter when it is stiff. Then there may be a cut consisting of cars carrying loads of varying weight to the same destination.

TRAINWARD BOUND

The car in the center has just passed over the master retarder in the foreground to slow it down partially and is on its way from the hump to its allotted track in the westbound yard. Farther along, as it goes over other retarders controlled from the tower at the left edge, its speed will be further reduced. Lines of vertical air cylinders that operate the retarder are on each side of it. Actuating the pistons squeezes the wheels between shoes on both sides of them.

CAR-RETARDER OPERATOR

From his position at the console he has an excellent view of the humping and retarding stations. Note the switch list in front of him, the track-number indicator panel at the left and the communications system at the right.

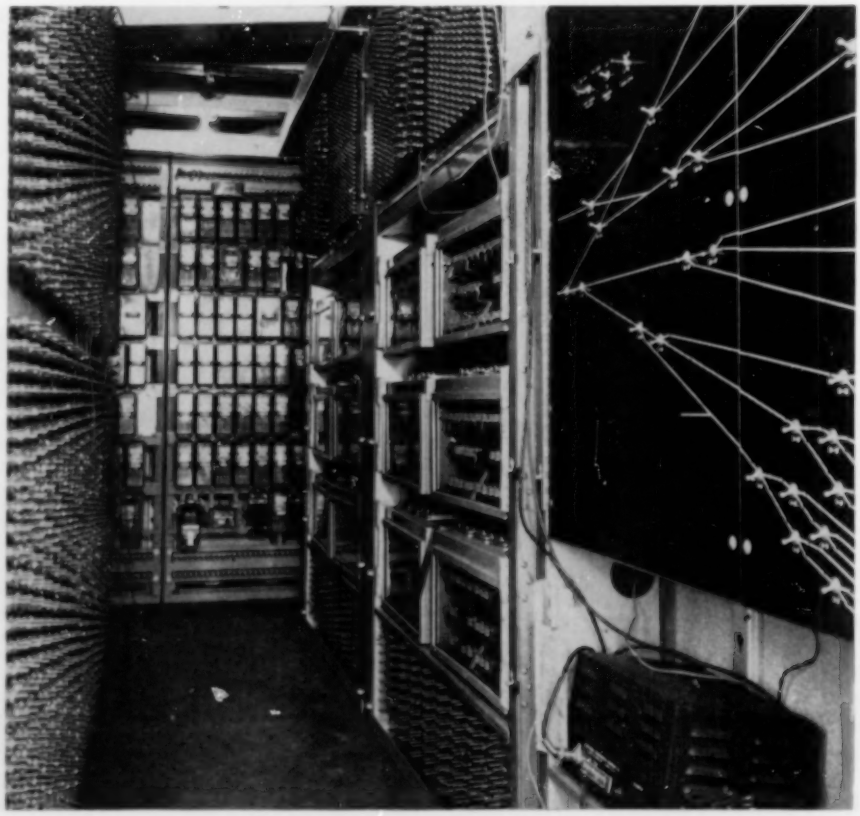
This creates a problem as to the speed at which it should be released from the final retarder. A high wind may also affect the release speed and must sometimes be taken into account. Remember, each car or group of cars should reach the end of the train of which it is to be a part with enough momentum to effect coupling but not so much as to jar the rolling stock harmfully.

With all that in mind let's return to the switch foreman. He sits at a desk-type routing panel having a switch button for each classification track. By pressing a single button he actuates electronic controls that cause pneumatic switches to direct the car or cars to the track corresponding to that button. He has before him a copy of the switch list for the 135-car train — is in contact with the diesel switch engine by a dual radio system covering the entire yard and nearby incoming and outgoing trains — has a paging and "talk-back" loudspeaker system to give instructions to the switchman uncoupling on the crest of the hump and to any other ground personnel, and is in communication by radio telephone and pneumatic tube with the yard office, the yardmaster's office and the two retarder towers.

As the locomotive pushes the train, the switchman uncouples the cuts. These may be routed to any one of five tracks which the switch foreman can select in advance of release and which are indicated on an illuminated panel in front of him (there is a duplicate panel on each retarder operator's desk). As the cut advances toward the retarders, the right switches are automatically thrown to direct it onto the chosen track. The switch panels are also provided with levers for emergency manual control of switches, cancellation buttons for changing a route and lights that show switch-point positions and clearances. Intricate though the electrical, mechanical and pneumatic classification system is, it can be depended upon to respond instantly to the pressure of a fingertip. It is the result of years of development by Union Switch & Signal Company, specialists in railroad apparatus.

Once a cut is routed and gains momentum as it rolls down the hump it is out of the hands of the switch foreman and the switchman and becomes the sole responsibility of one of the two retarder operators each atop a 30-foot glassed-in tower that is close to all retarders and gives him full visual command of the entire yard. Just below the crest over which all cuts must pass there are a master retarder, four intermediate retarders and eleven final retarders. Normally, the master and intermediate ones are set so that cars leave them at speeds from 6 to 12 mph, depending on the variables mentioned previously. Those in the last group are controlled so that cuts are released at speeds from 4 to 10 mph, also depending on the variables and on the distance they must travel to couple them on to their respective trains. Track grades beyond the final retarders are critical and operators must be thoroughly familiar not only with them but with track curves and other factors.

Tower A is in control of nine retarders for the 37 eastbound tracks and Tower

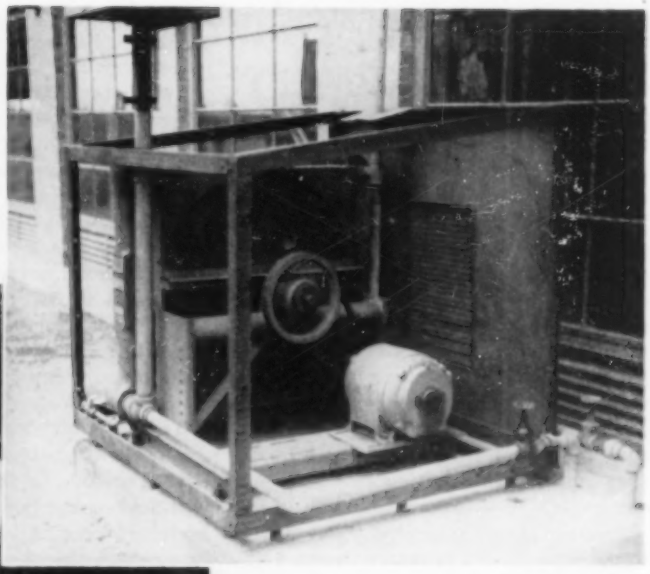


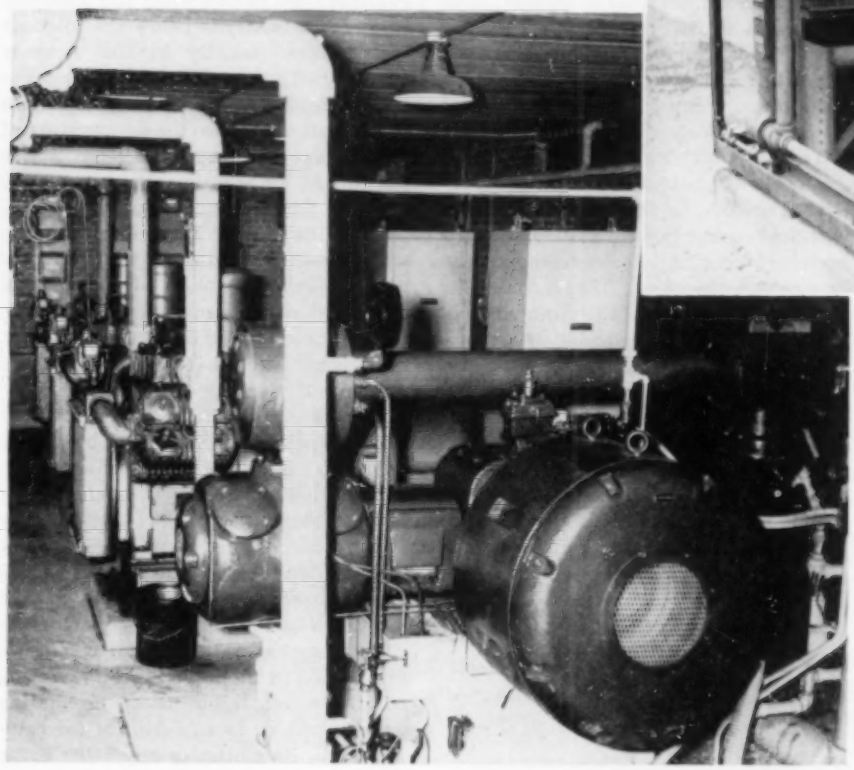
YARD NERVE CENTER

Interior of the instrument house adjacent to retarder tower A. The basic controls for the electropneumatic switching and retarding gear are located there. At the right is a section of a miniature yard layout that serves as a test panel on which electronic trouble at any point in the yard can be isolated.

SOURCES OF COMPRESSED AIR

Four Ingersoll-Rand compressors (below) supply all the yard's requirements. The one in the foreground is a Type PHE heavy-duty, 504-cfm water-cooled unit and back of it are three 75-hp, 387-cfm air-cooled Type 40 machines. The latter are arranged to come on the line individually as needed to meet varying demands for air. As water is scarce, the cylinders and intercooler of the PHE compressor are cooled by a closed circulating system that works like that in an automobile. During each circuit the water itself is cooled in a fan-type radiator (right) outside of the building.





B of seven for the 33-track westbound yard. In the towers are retarder control machines, mechanical marvels with consoles on which is a miniature diagram of the yard layout with speed-control levers in groups of six located at points corresponding to the retarder positions. If a car is heavily laden, the operator pushes a lever in one direction, if the load is light he reverses it, the retarders automatically applying the right braking pressure to slow down the cut as desired as well as to provide the necessary spacing between cars. If all the cars were released singly and were of the same weight and rollability the retarder operators could set their levers and know that their jobs would be properly performed. But as has been pointed out before, this is not the case and they must pay close attention well-nigh continually.

On each console above each group of speed-control levers are two toggle levers for manual control. These may be set in any one of four positions—automatic, heavy, light and off. When in the "automatic" position, the six levers, with numbers above them indicating departing speeds, govern the retarder; when at "heavy" or "light"—full or half pressure, respectively—the retarder is under manual control; and at "off," the retarder is released.

Also on the console are colored lights which show the operator when a cut is approaching a switch, when it is obstructing branch tracks and when it is in the clear. Normally they are not necessary for his guidance, because he can see any traffic irregularities from his vantage point. But the yard works around the clock and in all weather. While many floodlights penetrate the darkness, the retarder operator must go "on instruments" day or night during a heavy fog. With his switch list, his communication system, his automatic controls and clearance lights he can carry on satisfactorily even with the entire yard shut off from view. One operator expressed it this way—"It isn't comfortable, but it can be done."

The Union Model 31 Electro-Pneumatic Car Retarder installed at Bensenville uses compressed air as braking power and is applied through the action of air cylinders on brake shoes brought to bear on both sides of the wheels of a car. Compressed air lends itself especially well for this purpose because it responds instantaneously and combines "firmness" with resilience. Furthermore, its cushioning effect in the cylinders compensates for any unevenness in brake shoes and wheels so that shocks are not transmitted back to electrical equipment or through mechanical devices.

Each retarder at Bensenville is in two sections of varying length, depending on the service. Their air cylinders are on 6-foot 3-inch centers and operate in a unique manner in that the piston and the cylinder, both moving through linkage suspended under the rail, actuate opposing shoes simultaneously and with equal braking power. The arrangement is such that the cylinder section is raised to force the outside shoes directly against the outside of the car wheels while the piston section is lowered to transmit a like upward motion through the fulcrum and to push the inside shoes against the inside of the wheels. The master retarder has fourteen cylinders on each side of its two sections, while some of the final retarders are equipped with only ten pairs.

When on automatic operation, electrical relays every few feet along a retarder busily engage and disengage the shoes with varying pressures until the cut is slowed down to leave the retarder at the exact speed set on the operator's panel. It is almost fantastic to see a retarder some 70 feet long reduce the high speed of a heavy cut within its length in a few seconds. It isn't a single action, but a series of shoe squeezes as successive relays dictate different braking pressures throughout the course of the retarder.

It isn't within the scope of this article to trace the electronic circuits and to describe the intricacies of the system. Suffice it to say that all the equipment must be sturdy, reliable and readily accessible for inspection, maintenance and repair. Retarding control consoles, for

example, feature panels that can be raised and bases with removable covers to expose the terminal compartments.

Because freight classification is a continuous operation, switches and retarders need a full head of air to function properly—partial or sluggish performance is not permissible. It is therefore vital that an adequate and dependable supply be available at all times. The compressor plant at the Bensenville yard consists of an Ingersoll-Rand PHE unit and three standbys balanced to deliver air at pressures between 105 and 125 psi. As pressure in the system drops through consumption, the auxiliaries automatically come on the line; as pressure builds up towards the top limit, they automatically cut off and the main compressor goes to half-load operation.

Because they are located where water to cool machinery is scarce, many railroads use air-cooled mechanisms. Bensenville is one of these "dry" yards and its three peak-load compressors are air-cooled units. However, the base-load machine, the heavy-duty, water-cooled PHE, is equipped with a self-contained cooling system. This unit has a capacity of 504 cfm at 115 psi, and because it is capable of continuous, round-the-clock operation, unattended much of the time, is highly desirable for the job.

To cool the PHE and its intercooler without consuming water the following system was devised: A fan with a radiator of Young Radiator Company manufacture was installed outside of the building and fitted with a 3-5 hp, 2-speed, totally enclosed weather-proof Allis Chalmers motor. Inside the structure is an I-R close-coupled motor pump driven by a ½-hp motor and rated at 15 gpm under a maximum head of 60 feet. The water and antifreeze coolant is pumped from the radiator and circulated through the intercooler, through the low- and high-pressure compressor cylinders and thence back to the radiator for cooling.

The installation results in economies and other advantages that are noteworthy. Per 100 cfm of air, the main unit with its fan and pump requires approximately 8 percent less horsepower than an air-cooled machine. This accounts for a considerable saving in the annual power bill. It is recommended that 12½ gpm of cooling water be used for the two compressor cylinders and the intercooler. Even if water were available for cooling as commonly practiced, its cost per annum could be greater than that of the electric energy required for the fan and pump motors

Because the brake horsepower of a compressor is related to the cooling effect to which it is subjected, it must be noted that the temperature of the coolant in the closed system described will be higher in summer than that of the water from the usual outside source. However, this is balanced by the wintertime effect when the coolant is much colder than the commercial water usually available.

In the case of some compressors cooled with water from an outside source the cylinder bore sweats when the temperature of the water is below the inlet-air temperature (usually in the summer time). But in the Bensenville installation there is no chance of cylinder-bore condensation because the temperature of the coolant is always somewhat above that of the air entering the compressor. Another factor that is especially beneficial in the warm months is that the water-cooled machine with its outdoor radiator exhausts most of the heat of compression to atmosphere—not, like the air-cooled units, into the compressor room where it contributes to heating of motors and starting equipment.

Because the plant operates virtually unattended during two of the three daily shifts and over the weekend it is protected with safety devices and there is an automatic cut-in for the standby units. The compressor running gear has a forced-feed lubricating system with a low-oil-pressure shutdown, and on the discharge end of the main machine is a high-temperature shutdown which goes into action in the event of the following contingencies: failure of the circulating water pump or its driver or of the cooling fan or its motor, or any other cause that would raise the temperature of the discharge air beyond its normal point. Should any of the safety devices stop the base-load unit, the standby compressors would, of course, start up automatically and classification would proceed without a hitch.

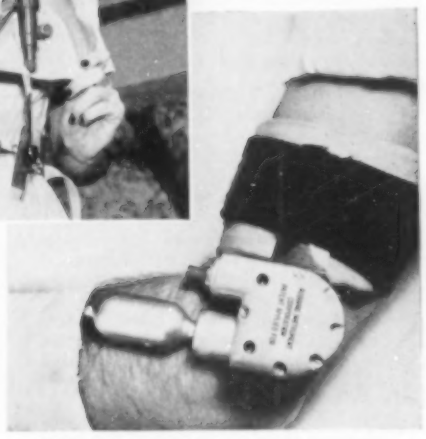
MAINTENANCE WORK

Necessary repairs or upkeep of equipment in the busy yard must be done quickly and correctly. As compressed air is at hand, pneumatic tools are the logical choice for many jobs. Shown here are Ingersoll-Rand 1- and 2-man pneumatic Impactools turning nuts on retarder gear.

BOTTLED PNEUMATICS

Little cylinders, jam packed with gas power, find increasing use in industry and consumer products

Robert J. Nemmers



SOME CYLINDERS AND TWO OF THEIR USES

Several of the many sizes of Hi-Pac disposable cylinders are pictured above. The center row illustrates the progressive manufacturing steps by the cold extrusion process. Two ways in which the cylinders are used to help save lives are shown at the upper-right. The young lady is wearing a life preserver that is inflated by means of small gas cylinders housed in totally enclosed valving mechanisms. When cords attached to short levers are pulled, pins puncture coined flats on the cylinders and release the gas which distends the preserver, as pictured. When deflated it is much less bulky. The jacket is manufactured by Air Cruisers Company. The other view shows a Robbins Instrument Corporation tourniquet that is provided with a cylinder. When inflated, it exerts pressure to halt the flow of blood and maintain regulated and uniform pressure on the artery, even compensating for changes caused by muscular flexing or variations in altitude (as when aloft in an airplane). Easily applied even by a wounded person, the cycles of pressure and no pressure are controlled by a push button. The Hi-Pac and Robbins companies are working on other medical devices that will use pressure pellets and cylinders.

COMPRESSED-air power, after a long and varied history, has now reached a stage where it is well-nigh indispensable to industry as a whole. More than ever before designers are tu. ning to pneumatics to solve difficult problems in control and to provide fast hard-hitting power as well as a sure source of emergency energy. In the past but one obstacle stood in the way of attaining these ends; that is, the pressure-generating equipment was more often than otherwise too large, thus defeating its purpose.

Obviously, the solution lay in providing a container small enough, cheap enough and strong enough so that a gas could be packed into it under high pressure and stored until needed. A power package of this kind would last indefinitely in storage and would not lose its potential as do electric batteries. Such a container was not available until comparatively recently, but at that time not at a cost that made it possible to put compressed-gas power packs in general use. That has come about only in the last few years. Their first application was in portable fire extinguishers of the carbon-dioxide-gas blanket type. Later models, some of which are still popular, are charged with a fire extinguisher, frequently carbon tetrachloride, under high-pressure gas.

Next, the small cylinders served as a means of carbonating water in the home. The apparatus with which they were used, a so-called soda siphon, is composed of a receptacle with a recess. In the former is placed a given amount of water and in the latter a small cartridge of liquid carbon dioxide. By aid of a screw cap the cartridge is forced down onto a pin, thus puncturing a coined flat on its head. The released gas enters the receptacle through a check valve and permeates the water when shaken. As the pressure of the gas inside the receptacle is above atmospheric pressure the siphon is self-dispensing. These cartridges are of the single-trip or disposable type and, in the beginning, were rather expensive. The marketing of cheap, bottled, carbonated water has all but finished the making of cylinders for this purpose. But even before the invention of the home siphon a somewhat similar but much larger refillable cylinder was, and still is, used extensively at soda fountains and bars for charging water.

Later on power packs came into service for inflating life rafts and jackets and to energize hobbyists' small models of cars, etc. Refillable types with standard automotive fittings also were produced for emergency tire inflation and experiments were conducted with self-dispensing pressure packages, a subject dealt with in the June, 1953, issue of this magazine. Today, the cylinders are embodied in commercial or sizable self-dispensing product containers and have led to a new but as yet largely untried concept in the retail or home-appliance field.

Known as "unpressurized-until-used" packages, they would enable a consumer to purchase a can or bottle of whatever he wanted, together with a simple cap-and-valve arrangement incorporating a receptacle or attachment for a third item —a small pressure package (ordinarily

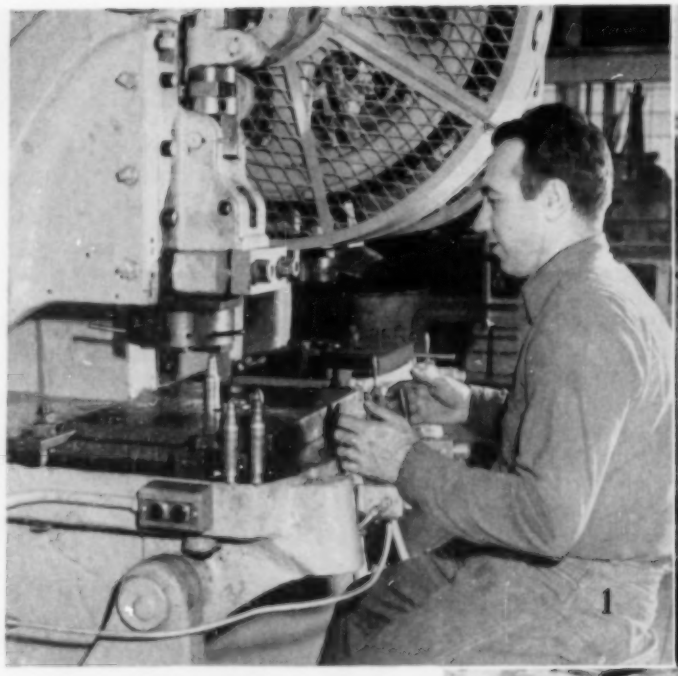
MANUFACTURING CYLINDERS

1 NECKING. The necking and coining operation on disposable, nonthreaded cylinders is carried out on one of 115 presses, all of which are equipped with dual air controls that keep both of the operator's hands out of danger as the ram descends. The company adopted this safety feature in 1915.

2 THREAD ROLLING. Necking and thread rolling on nondisposable cylinders are accomplished simultaneously merely by inserting the piece in the opening of the machine shown. In the background N.D. Vuyosevich, manager of the Hi-Pac Division, is seen checking threads.

3 CHARGING WITH GAS. A container of gas is dropped into the lower part of a special jig, and a valve mechanism for the admission of gas to the cylinder is screwed on top of it. The unit is then placed in a hydraulic clamp, which holds it during charging. Gases that liquefy under high pressure are loaded on a weight basis; those that remain gaseous are loaded on a pressure basis. After charging is completed, a hydraulic ram forces an upsetting pin into the opening in the cylinder and seals it.

4 MARKING. Compressed air and vacuum team up in two of the final production stages. The machine shown stamps the quantity of the gas charge and the trade name Hi-Pac on each cylinder by air power. In another operation (not shown) vacuum is used to test the cylinders for leakage under simulated high altitude conditions.



carbon-dioxide gas or Freon for general goods and nitrous oxide for foodstuffs). These he would assemble at home whenever he wished, and after that he would have to buy only the product and pressure cylinder, the valve being reusable. By this means it is hoped to cut the price of pressure-packaged commodities, to market many that could not be handled in this way heretofore, and to insure increased safety in shipment and storage. Too, it would simplify packaging itself—it would be possible to eliminate much of the elaborate equipment now needed to charge containers at one time with both the product and a high-pressure gas.

World War II and its continuing aftermath of strife among nations have given an impetus to the development of new products such as high-pressure packages. Demands by the fighting forces for simple, dependable emergency sources of power have resulted in the development of new types of cylinders and valves and have led to experiments with new methods of cylinder manufacture and charging, as well as with different kinds of gases. There was an almost insatiable demand for cylinders of all sizes and types to perform such services as opening bomb-bay doors, lowering landing gear, clearing jammed weapons and many other tasks involving both linear and rotary motions on aircraft, naval vessels and on equipment used by the ground forces. Their popularity may be better understood if we point out the phenomenal power packed in these little containers. Three pounds of liquid carbon dioxide, for example, produces 100 hp during a one-second release.

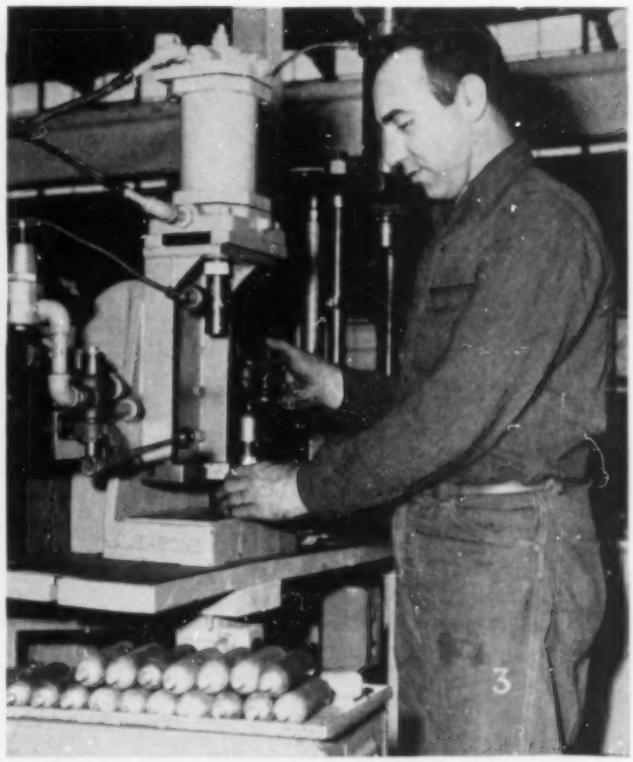
With widespread military applications came increased interest among designers of industrial and consumer products who saw almost unlimited possibilities in the compressed-gas "batteries" if they could be obtained in varied sizes at low cost. It was to explore this field that Worcester Pressed Steel Company, Worcester, Mass., organized, in 1953, its Hi-Pac Division (the name being a contraction of *hi*gh-pressure *pac*kage) with a key personnel whose experience goes back many years. N. D. Vuyosevich, present manager of the division, had formed the Hi-Pac Corporation in 1947 which experimented with some new ideas in cylinder design and began distribution in 1950. It continued in business until merged with Worcester Pressed Steel. It is with the operations and achievements of the latter's Hi-Pac Division that we are concerned.

The steps involved in making a cylinder follow the usual order—design, manufacture and charging, and it is in this sequence that they will be discussed. In designing a high-pressure package for any given application the first consideration is its general classification, that is, disposable or refillable. The former type is used with expendable equipment or where the return of the cylinder for recharging entails so much trouble as to cost more than it is worth. In general, small-size packages are disposable; larger ones are refillable.

Next, the physical dimensions of the cylinder must be determined, and these depend upon the amount of gas and the pressure needed to perform the job for which it is intended. With these figures established, plus a certain quantity of gas as a safety factor, it is easy to calculate its size. Finally it is necessary to decide on the shape of the package. That is based upon the space into which it must fit, and may be long and thin or short and fat.

Selection of the proper gas for charging depends on the service, as already mentioned. Carbon-dioxide should be used for all power purposes which require less then 840 psi pressure (the vapor pressure of CO_2) because it liquefies readily under pressure and therefore can store more energy per volumetric unit than gases that more nearly approach the standards expressed in the perfect gas laws. The only exception to this rule is where extremely low temperatures may be encountered. Under those conditions company engineers recommend nitrogen. Special applications may call for a flammable gas such as propane or butane or for life-supporting oxygen.

The materials of which the cylinders are made also vary with requirements



and Hi-Pac engineers specify carbon or alloy steel for general use at all pressures; stainless steel where corrosive conditions are present; brass or aluminum for equipment affected by magnetism and corrosion, the latter metal also for low-pressure service where it is necessary to conserve weight; and titanium, the newest material combining rust resistance and light weight with high strength, for special applications.

Like everything else about the cylinders, the means of connecting or coupling them to equipment differs considerably. In most cases, however, some type of threaded coupling is used. Snap-in (friction-lock) couplings are suitable for the lower range of pressures, and totally enclosed ones of the soda-siphon type also are available. For the threaded coupling, largely developed by Hi-Pac, an O-ring rather than a gasket-type seal is recommended especially where vibration is a factor. This is because the former will insure a tight seal even though the threaded connection becomes slightly loose.

What has been said of couplings also applies to release mechanisms. In the case of disposable cylinders, the valving is incorporated in the gas-using apparatus. The cheapest form, which at the same time assures tightness of the package during storage, is one that punctures a coined flat. For refillable containers a true valve is in order. It may be a simple ball check valve, a slotted spring stopper, etc.; it may be a very intricate device that responds to changes in temperature or pressure, or to the control of a cam or other cycling mechanism; or it may be any one of hundreds of other variations.

After all the variables cited have been determined the cylinders enter the manufacturing stage, and that is where the long experience of Worcester Pressed Steel Company comes into play. The firm pioneered in the making of high-pressure containers by the cold extrusion process, and it is by this method that the cylinders are produced today. Essentially, it involves cold forming of the steel from blanks all the way to and through the coining operation. It results in strong, cheap packages of lightweight alloys and superior finish and

CHARGING MINIATURE CYLINDERS

A quantity-production machine fills small cylinders, or "pellets" as they are known, with gas. This type of cartridge is often used in soda siphons. It is enclosed in working position in a receptacle and coupled to a puncturing pin and a valve mechanism. In the case of the smallest pellets attachment is made by a bayonet-type connection.

lends itself readily to making complicated shapes.

The company produces sheet and bar stock to meet its rigid standards in its own cold-rolled steel mill. (As a point of interest, it is said to be the only mill in the New England States that turns out cold-finished bar steel.) More than 115 presses are among the specialized tools installed there for cold forming jobs of all kinds, but only a few of the small and medium-size machines manufacture cylinders. Some of the larger presses, which are capable of exerting up to 1500 tons pressure, are used to make much bigger parts. All these machines are controlled or tripped by means of double or 2-hand air valves. It is worth noting that the first application of this safety device was made at Worcester Pressed Steel Company in 1915.

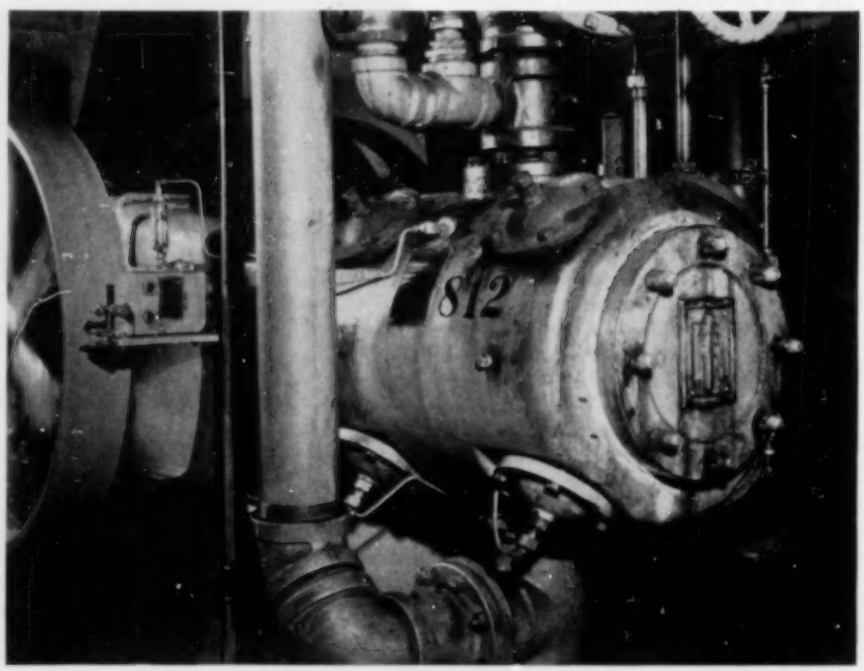
The actual forming of the cylinders is done in several steps, the number depending on the physical dimensions. Basically it consists of the first draw, a variable number of intervening draws, necking and, finally, coining. These operations are succeeded by thread rolling, stamping and charging, which is done on a weight or pressure basis. The different gases are purchased in large flasks and transferred to the small power packages by hydraulic cylinders acting as pumps. While this work is in progress, the packages themselves are held under high pressure in special jigs also by hydraulic cylinders. After charging is completed the pressure-pack opening is cold-upset and thus effectually sealed.

Along the route followed by the cylinders compressed air plays many important parts. Furnished by an Ingersoll-Rand Type ES single-stage machine, it is piped to all sections of the plant by a distribution system that is a model of efficiency. Leakage throughout is reduced to a minimum by means of certain preventive maintenance practices enforced by the company. The story of how this is accomplished was told in the July-August-September 1950 issue of this magazine.

As we have already said, the presses are pneumatically controlled. This alone requires a large volume of air. In addition, the identification marks on each cylinder are stamped on by aid of a pneumatic cylinder, as an accompanying illustration shows. There are also some hydro-pneumatic accumulators in service (most of the hydraulic power, however, is generated by a central pump unit), as well as other air applications that are not discussed because they do not specifically pertain to the production of high-pressure cylinders.

After charging, the cylinders undergo the last of a series of quality-control inspections and some of them are set aside for thorough testing in the laboratory. One phase of this work involves placing individual cylinders in glass vacuum chambers partially filled with water. When the air is evacuated from the chambers the packs are observed for leakage, which is indicated by bubbles. Tests are also made to check the effects of corrosion and temperature variations.

Today, Hi-Pac cylinders serve many different mechanisms performing virtually countless tasks. To list them all would take up too much space and is not even permissible because the bulk of the applications are of a military nature. It is the aim of the company to lay greater stress on general industrial and consumer items, thus bringing the advantages of compressed-air and gas power more than ever before to the attention of the public.



SOURCE OF AIR POWER

Compressed air for the Worcester Pressed Steel Company's plant is supplied by the Ingersoll-Rand machine illustrated. It is a single-stage unit with a capacity of 304 cfm at 85 psi discharge pressure.

Birthday of Gotham Subway

New York sundodgers have been riding underground for just half a century

1902 DRILLER'S STANCE

A hard-rock jockey, "riding" a tripod-mounted Rand drill, working at 119th Street and Broadway on the John Shields contract. The derby was the hard hat of that era.

FIFTY years ago this month New Yorkers were getting accustomed to the thrill of riding on their new underground railway. The first link in what is now the nation's most extensive subway system had been opened only a few days before—on October 27, 1904. It had been under construction for more than four years. Consisting of approximately 14 route miles and 65 miles of track, it extended up the east side of Manhattan Island from City Hall to 42nd Street, from there across town to Times Square, and then northward again. At 104th Street it divided, one branch going farther north to 230th Street and the other veering northeastward, crossing beneath the Harlem River into Bronx Borough and continuing on to Bronx Park. Of the 305,000 linear feet of track, 245,000 feet was below the surface and the remaining 60,000 feet, which traversed what was then suburbs, was elevated.

Its construction was a monumental job for those times and would be classed as a sizable one even today. It was contracted to one man, John B. McDonald, for $35 million, making it by far the largest building project ever delegated to one person. Only two bids were entered; the other one was tendered by Andrew Onderdonk. Mr. McDonald was notified on January 17, 1900, that he could begin work. He was required to post a performance bond of $14,000,000, which was later reduced to $5,000,000 by court order. McDonald planned and directed the operations, but divided the actual work into sixteen sections and subcontracted it among fourteen firms. Degnon-McLean was awarded three of these and William Bradley and the firm of Farrell, Hopper & Company each got two.

Construction of the initial subway followed 35 years of discussion and planning. The New York City Underground Company obtained a charter in 1866, but never reached the building stage. In 1870 the Beach Underground Pneumatic System opened for demonstration 200 feet of line under Broadway between Warren and Murray streets. Cars that fitted snugly in a circular tube were moved by air pressure, much as pneumatic tube carriers are transported. The riding public didn't think much of the scheme, and plans to expand the system were abandoned. In 1872, the New York City Rapid Transit Company, backed chiefly by Cornelius Vanderbilt, tried unsuccessfully to promote a subway.

In the same year the idea of constructing subways was shelved and remained in abeyance for twenty years because of the inauguration of an extensive elevated railway system. The first overhead line ran from Battery Park to 30th Street via Greenwich Street and Ninth Avenue. It was later extended to 155th Street, and other "Els" were built in quick succession. All the trains were at first drawn by steam locomotives.

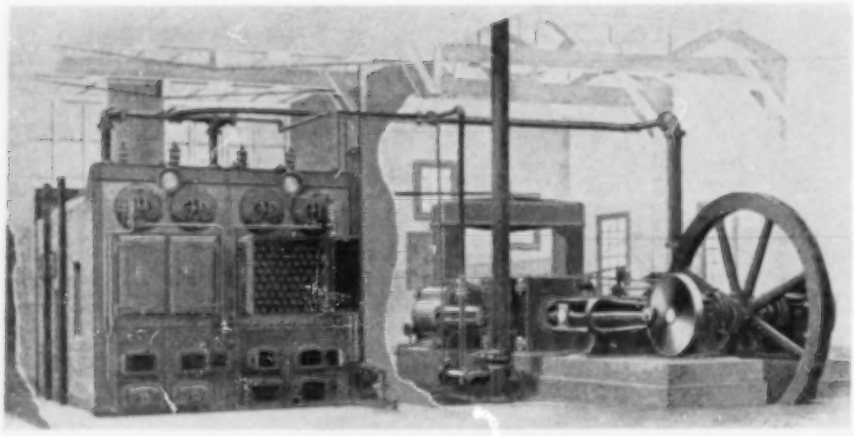
Those facilities only partly solved the transit problems of the rapidly growing city and, when agitation for subways began anew, Mayor Hugh J. Grant appointed the first Rapid Transit Commission in April, 1890. It held many meetings and considered many different plans. When property owners along the proposed route under Broadway and Madison Avenue objected, the project was stalled by court action. After those obstacles had been removed in 1892 bids for the first section of the proposed line were advertised. But capitalists, fearing that the enterprise would not be remunerative, declined to back contractors and there were no tenders.

Six years later all road blocks were finally cleared away and Messrs McDonald and Onderdonk submitted bids for a revised building program on November 13, 1899. McDonald's contract called for completion of the line within 4½ years and gave him the privilege of operating it for 50 years if he so elected. Ground was broken by Mayor Robert Van Wyck in City Hall Park on March 24, 1900, and actual work was begun two days later at Bleecker and Greene streets.

The subway was needed badly because the population of the city had spurted

CONSTRUCTION ON ELM STREET

When property owners objected to a subway under lower Broadway the route was shifted eastward to Elm Street, much of which is now Lafayette Street. The construction there was all of the cut-and-cover variety, the excavation being in sand and gravel some of which was used in making concrete. Many of the adjacent buildings with shallow foundations had to be underpinned.



TYPICAL COMPRESSOR PLANT

The boilers on the left supplied steam for operating the Rand-Corliss compound compressor of 48-inch stroke. The air was used by two contractors, Ira A. Shaler and Degnon-McLean, in the 42nd Street area.

from 70,000 in 1800 to 3,500,000 in 1900. Manhattan Island, even more so than now, was the center of business and commerce and consequently the first of the city's boroughs to get an underground railway. Aside from the people concentrated there, certain physical conditions have always complicated the traffic problem. The 22-square-mile island extends northward from the Battery for 13½ miles and has an average width of only 1⅘ miles. Most blocks measure 600 to 800 feet east and west and 200 to 300 feet north and south. This layout provides few north-south surface travel arteries and makes for congestion.

Specifications called for a 4-track system with express and local trains running in both directions. The aim, in general, was to keep the roof of the structure 4 or 5 feet and the station platforms 16 to 18 feet below street level, with the maximum depth of cut about 21 feet. This plan promised to effect savings in excavation costs; make it easier and safer to sheath the openings because they would usually not extend below the foundations of bordering buildings; and give riders fewer steps to negotiate than they had to climb and descend in going to and from elevated railroad stations.

Within the cut the lines pass through a composite skeleton of concrete and steel and are surmounted by the various utility pipes and conduits encased in earth and topped by the street paving. The steelwork consists for the most part of I-beam posts, spaced 5 feet apart, with connecting roof members. This open-cut pattern of construction could be followed wherever the surface of the ground was reasonably level, which was the case throughout nearly all of the southern and middle sections of the route. In the upper reaches, more hilly terrain called for tunneling.

Manhattan Island has a backbone of rock covered in many places by little or no soil. Consequently, of the 3,212,000 cubic yards of material that had to be excavated, approximately 1,900,000 was in earth and 1,312,000 in rock. Of the latter, 884,000 cubic yards was removed from open cuts and 428,000 from tunnels. With 40 percent of the ground requiring drilling and blasting, the rock drill became an indispensable tool. London, Paris and Boston had already built subways, but all through earth.

The New York project could hardly have been tackled if the mechanical rock drill had not been available. It is not known how many were utilized, but a publication issued by the Rand Drill Company in 1902 listed 179 of its machines as then in service, not to mention those of competitive make. Several models of Rand drills were in use, with the 3½-inch size predominating. All drills of that era were of the heavy, relatively slow but remarkably durable piston type. In open-cut work and for sinking shafts they were invariably mounted on tripods having heavy weights on the legs to hold them steady. In tunneling, both tripod and bar mountings were employed.

In those days many rock drills were operated with steam instead of compressed air and in the beginning some of the contractors were undecided as to which power medium to use. As they had other equipment such as hoisting engines, pumps, etc., that could be run with steam, they stationed boilers at various points along the line, moving them from time to time as required. However, most of them decided on air power, which had already proved its effectiveness on such big construction jobs as the Chicago Drainage Canal, the new Croton Aqueduct for New York City and various railroad tunnels.

One strong argument was advanced in favor of air instead of steam and that was that it could be utilized for running riveting hammers, which were essential in erecting the extensive steelwork. Portable air compressors had not yet made their appearance, so stationary units were placed at convenient locations from which the air was distributed. Most, if not all, of the compressors were operated by steam, and some had air cylinders

WHERE BUILDINGS WERE RAZED

Looking northward across a section near 42nd Street and Fourth Avenue where several buildings were removed to make room for the subway. Grand Central Depot, which then occupied the site of the present Grand Central Terminal, is in the background.

HANDLING MUCK ON BUSY STREET

A bucket of excavated material delivered by aerial tramway about to be dumped onto a sloping platform that facilitated loading it into horse-drawn wagons. The scene was on the north side of 42nd Street near Fifth Avenue, sometimes called the "Crossroads of the world."

with a 40-inch bore and a 48-inch stroke.

Northward of the starting point as far as 14th Street the excavation was mostly in sand and gravel. A loop provided under City Hall Park for turning trains around was tunneled under the vaults of the General Post Office without disturbing them, and in other parts of the downtown area the excavators worked close to the foundations of the city's tallest buildings, which then had a maximum height of 28 stories.

When property owners along lower Broadway made it plain that they did not want the subway there, it was shifted to Elm Street. Originally narrow and crooked, this thoroughfare had been widened and straightened to take some of the traffic off Broadway but not opened, thus enabling the constructors to occupy its full width. It was stated at the time that the existence of this street made the building of the initial subway financially possible because the cost of laying it under crowded lower Broadway would have been prohibitive. At one point on Elm Street the workers cut through the filled-in Collect Pond, which had been a Manhattan landmark before the city swallowed it.

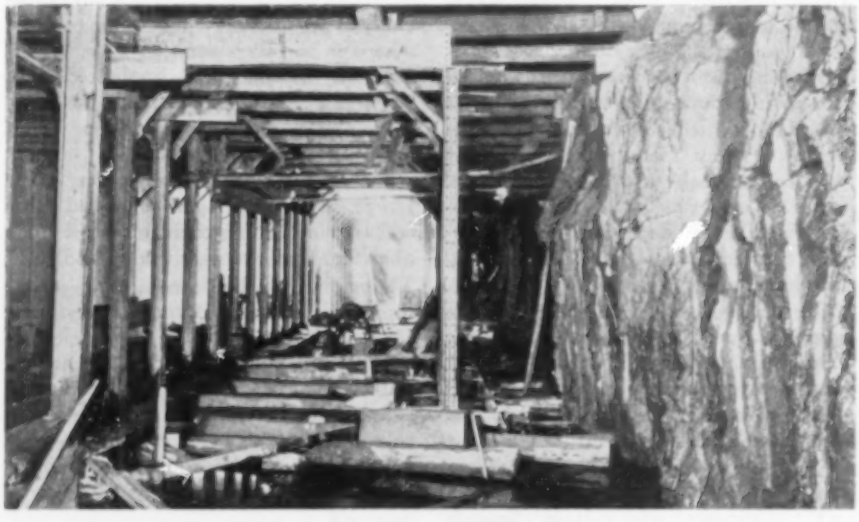
At 14th Street the excavators hit their first heavy rock, and much of it was encountered from there on northward. The crosstown link under 42nd Street was considered one of the most difficult sections, but it was completed on time despite the fact that it was started a year later than the other sections. Proceeding up Broadway from 42nd Street, the line was run under one corner of the massive Columbus Monument at 59th Street without causing any settlement of the structure or its foundation. In this area was built the first station, which became somewhat of a model for the others. Various types of floor and wall finishes offered by competing manufacturers were incorporated there to compare them.

The system's first tunnel in rock was driven under high ground from 104th Street northeastward to Lenox Avenue. Two shafts were sunk to give access to it and these remained in use after they had served that purpose by installing elevators. At both 169th and 181st streets stations were hollowed out of solid rock 110 feet below street level. At 116th Street one of the contractors put up New York City's first electric cableway for handling muck.

A construction army of 10,000 men was engaged in the huge burrowing job for nearly five years. When it was at last completed trains began roaring through the subterranean passageways at 40 miles an hour and the slogan, "from City Hall to Harlem in 20 minutes," was a reality. It had sustained the campaign for rapid transit for twenty years.

That was the beginning of the wondrous and ever-growing Gotham subway system. Soon it was extended down Broadway to the Battery and thence under the bay to Brooklyn. Since then numerous other lines have been put in service to tie the wide-flung city together. The network now reaches into all the five boroughs except Richmond, which is Staten Island. Isolated by water stretches that have so far been too forbidding to cross, it still relies on ferry connections with both Manhattan and Brooklyn.

New York's rapid-transit system, including subway and elevated lines, now totals 236.59 route miles. The municipality owns all of it, and its investment aggregates $1,757,000,000. Of this sum $1.44 billions was spent directly on construction and $317 million for acquiring privately financed lines under a unification plan that was adopted in June, 1940.



TYPE OF STEELWORK

Framework for one track partly in place on 42nd Street between Fifth and Sixth avenues. About 65,000 tons of structural steel was used in building the line.

THEY EAT GOOD

The dining tables of the frugal Pennsylvania Dutch people are loaded with tempting food

Jane S. Muller

GOURMAND'S PROVERB

The inscription on this reproduction of an old Pennsylvania plate reads: "It's better to burst the stomach than to throw away food."

ONE of the few luxuries the Pennsylvania Dutch permit themselves is a "good table." For many generations tillers of the soil in Europe and then in the United States, the palatability of the fine produce of their farms is further enhanced by the *Hausfrauen* who have always prided themselves on being excellent cooks. There is individuality in the fare and social customs of these sturdy people. Well-nigh inseparable from their love of good, substantial food is the hearty hospitality offered—in fact, insisted upon.

Most of the womenfolk brought to this country traditionally German recipes, but as many of the essential ingredients were at first unavailable it became necessary to change them or to develop new ones based on the foodstuffs and seasonings at hand. The dishes thus created by the ingenious pioneer women have brought fame to the Pennsylvania Dutch region. Many foods which stemmed from the kitchens of the area are now marketed on a nationwide scale and include such products as pretzels, doughnuts and crullers, sauerkraut, apple-butter and cottage cheese.

Cheese is one of the first foods man learned to prepare, and cottage cheese is thought to have been the earliest manufactured dairy product. It and cream cheese are two popular unripened varieties, which means that they are not aged before being eaten. For this reason they are the easiest to make at home, and it is apparent why cottage cheese is so named. Its clean mildly acid flavor is distinctive and appeals to most palates.

The basic ingredient of cheese is coagulum or curd which forms when milk is soured either naturally or by the addition of rennet and which contains all the nutritious substances in milk.* The first step in producing cheese is to separate the curd from the whey—the fluid part of milk which is about 93 percent water. Rennet is found in the stomachs of bovine animals, and as the ancients were known to carry milk in containers made from the stomachs of calves it is very likely that some herdsman discovered the phenomenon of coagulation in such a receptacle and thus started the chain of events that led to the cheese-making process.

Cottage cheese has long been prepared in homes throughout America, and especially in the Pennsylvania Dutch country where it is called schmier-kase, smier-kase or schmiercase, anglicized into smearcase, and also Dutch cheese. One story has it that outside of every Pennsylvania Dutch housewife's kitchen stood a tree with one well-worn lower bough on which a bag of whey and curds was regularly hung to drain. How to go about making cheese is told by Edith F. Thomas in her 1915 book, *Mary at the Farm — A Visit to the Pennsylvania Germans:*

"Stand a pan containing 3 quarts of milk in a warm place until it becomes sour and quite thick. Stand the pan containing the thick milk on the back part of the range where it will heat gradually but not cook. When the 'whey' separates from the curd in the center and forms around the edges, it is ready to use. Should the sour milk become too hot on the range or scald, the curds (smier-kase) will not become soft and creamy. When the curd has separated from the whey, pour contents of the pan into a cheesecloth bag and hang it in the open air to drip for several hours, when it should be ready to use.

"From 3 quarts of milk you should obtain one good pound of smier-kase. To prepare it for the table, place one-half the quantity in a bowl and add one tablespoonful of softened butter, a pinch of salt and mix as smoothly as possible. Or the smier-kase may be molded into small rolls, and a small quantity of chopped pimento added. This will stay fresh for several days if kept in a cool cellar or refrigerator." According to another recipe you mix the curd in a large bowl with cream, pepper and salt and just before serving float cream on top and sprinkle with paprika and chopped parsley or chives.

Probably one of the most publicized of the Pennsylvania Dutch customs is that of providing seven sweets and seven sours at each meal. It has been said that dinner guests were prone to count the heaped dishes and chide the hostess if even one was missing. However, Ann Hark and Preston A. Barba, co-authors of *Pennsylvania German Cookery*, aver that "bounteous though our tables be

*When coagulated, skimmed milk yields about one-tenth its weight in curd, which is composed approximately of 89.3 percent water; 27.8 percent protein, essentially casein; 6.4 percent fat; 5 percent milk sugar; and 1.5 percent salts, especially calcium phosphate.

Snacks 'n' Sweets
HOTEL BRUNSWICK
Lancaster, Pa.
In the Heart of the Pennsylvania Dutch Country
Snacks 'n' Sweets
HOTEL BRUNSWICK
Lancaster, Pa.
In the Heart of the Pennsylvania Dutch Country
Distelfink
"It wonders me!"
"Don't be so doppick!"
"You must be forhext!"
Sarah spritzes the lawn
Lemmie makes the grass off
"It rotters here!"
Elmer's tooth mushes him!"
Daniel loves to drink Fastnachts
"Papa's on the table and half at already!"
"Katy's hair is so stroody!"
Aunt Minnie is wonderful fress
Jonathan attends the light
"Suck a piece of schmootzer's!"
Rachel's busy
satisfying apples
So you'll know what to say... when you're down Pennsylvania Dutch way

PENNSYLVANIA DUTCH MENU
A black-and-white reproduction of the front and back cover (it folds in the center) of a gaily colored menu that is offered diners at one of the popular eating places in the Pennsylvania Dutch country. Typical expressions heard in the area are illustrated. A list of a few of the Pennsylvania Dutch dishes on the menu is shown at the right.

Pennsylvania DUTCH DISHES and DESSERTS*

Hinkel Welschkarn Supp: (Chicken Corn Soup)	Cup .15	Bowl	.25
Panhaas mit ferbrennt Broot (Scrapple with Toast)	.35	un mit gabroda Oi (and with Fried Egg)	.55
Frankfurter mit Sauer Graut un Grumbier, Broot (Frankfurters with Sauerkraut and Potato, Bread)			.65
Shoo-fly Pie			.20
Cheeses served with Saltines:			
Schmier Kaes (creamy Lancaster County cottage cheese)			.30
Schweizer Kaes (a Swiss cheese made by the Amish)			.30
Koppli Kaes (Cup Cheese)			.30
Liederkranz			.30

*Other Pennsylvania Dutch dishes featured on our daily menu.

we have never met with the 'seven sweets and seven sours' served up so generously in books published about the Pennsylvania Germans in recent years."

One of the sweets is applebutter, the making of which was never considered a chore but rather an eagerly anticipated social event in the fall. It was cooked outdoors in huge iron kettles, and guests shared in the work, the fun and the refreshments as they took turns stirring continually as the kettle simmered. An important item in the Pennsylvania Dutch cuisine, applebutter appeared on the table at every meal in many homes. It was and still is considered especially tasty on top of cottage cheese spread on fresh homemade bread.

A recipe for applebutter pie is offered by Miss Lottie Gable in the Hark-Barba book and suggests a mouth-watering spiciness:

3 cups applebutter
1 cup water
2½ tablespoons flour
½ teaspoon cinnamon
¼ cup sugar
2 unbaked pastry shells

"Combine applebutter and water. Sift the dry ingredients and add to mixture. Pour into pastry shells and top with narrow twisted strips of pastry. Bake in a moderate oven at 350°F for about 35 minutes."

Germans arriving in America from the Palatinate had been accustomed to making a "spread" from plums or pears because those fruits did not keep in storage. The abundance of apples in Pennsylvania probably accounts not only for the applebutter but also for the wide variety of other wonderful dishes with apples as the basic ingredient. Apple pie has been baked in so many guises that Pennsylvania Dutch cooks have ably demonstrated their culinary art in this one field alone even though the pastry was originally foreign to them. Pie, as the pioneers came to know and prepare it, was an adaptation of an English dish.

Shoofly or molasses-crumb pie can be one of the most tempting delicacies to leave a Pennsylvania German oven, although a controversy has raged for generations as to how it should be baked.

BETTMANN ARCHIVE PRINT

ITINERANT CHEESE MAKER

The Germans who settled in Pennsylvania brought with them from abroad a decided liking for cheese and recipes for several kinds, of which cottage cheese was the standby. Every early home had facilities for making it. In various parts of Europe traveling cheese makers went from house to house carrying their equipment. The one pictured was from the Lake of Brienz area in Switzerland.

Actually cake, there are those who like it with a syrupy molasses-mixture layer on the bottom, while others prefer the filling dry. A recipe which, if made in quantity, permits a family to have its shoofly pies both ways in one baking to satisfy individual tastes comes from the Allentown area.

To make the crumbs, mix 1½ cups flour and one cup brown sugar. Rub in by hand ¼ cup shortening. The liquid or syrupy part calls for ¾ teaspoon baking soda, ⅛ teaspoon nutmeg, a little ginger, cinnamon and cloves, ¼ teaspoon salt, and ¾ cup molasses. Stir well before adding ¾ cup hot water. At this point choice as to wet or dry crumb pie dictates the procedure to be followed. For the former, which is the traditional pastry, the liquid is poured into the unbaked pie shell and the crumbs are sprinkled on top; for the dry pie, the liquid and crumbs are alternated, beginning and ending with crumbs. Bake at 450° for fifteen minutes; then reduce the heat to 350° for twenty minutes. The quantities given are sufficient to fill one large pie shell.

Another Pennsylvania Dutch dish about which there are two schools of thought is pepper pot. Philadelphia pepper pot is made with tripe and a veal knuckle, while the other version of this thick soup, which seems to be preferred today, is made with beef, omitting the tripe. A good-sized beef soupbone is cooked in salted water with a diced onion until the broth is rich and the meat tender. Bone and meat are then lifted out and replaced by diced potatoes. When they are mealy, the beef, cut into fine pieces, is returned to the pot, which is allowed to simmer gently. Dough, much like that for pastry but not so rich, is an integral part of the dish. If desired, cooled broth rather than water may be used for the dough, which is rolled out thin and cut into bits not more than ¾ inch square. Before adding these to the soup, the good *Hausfrau* cautions, the pot should be pulled away from the heat so the broth will be quiescent, for any motion would cause the dough to dissolve before it has set.

Like so many recipes this one is literally "handed down," and each new cook is instructed to add sweet marjoram to taste. As the herb imparts the highly desired flavor to pepper pot, the generous hand of the cook should not be stayed when adding it. A properly prepared bowl of pepper pot is of the consistency of a stew with well-seasoned morsels of meat, potatoes and dough. This hearty soup improves with time, usually tasting even better the second day.

Apples, ever present in Pennsylvania Dutch menus, appear again among the soups. Fruit soups are of German origin, according to *Pennsylvania German Cookery*. The book contains a number of recipes for such soups, one of which calls for four large apples, 1 stick cinnamon, the juice of half a lemon, lemon rind, 2 tablespoons cornstarch, ¼ cup currants and a cup of red or white wine. Unpared, the fruit is cored, cut into small pieces, covered with water and, after adding the cinnamon, lemon juice and rind, boiled until nearly soft. Then the cornstarch mixed with a little water is put in the pot and cooking is continued until the apples are done. The mixture is strained, currants and wine are added, and the soup boiled about five minutes longer. It is a delicious concoction and may be served either hot or chilled.

One of the best known of all Pennsylvania Dutch dishes is *schnitz und knepp*—apples and dumplings. The apples, with skins intact, are cut into six or eight sections, strung and hung to dry behind the kitchen range, on the open hearth, or in an outdoor oven. Placed in bags, they are stored in a dry place for use during the winter months. The dumplings, in company with schnitz, add greatly to the tastiness of many meats. Prepared of flour, butter, milk, yeast, eggs and salt, they are light and spongy after cooking for fifteen minutes in boiling water. They are often put in fruit compotes or meat stews. The uses of schnitz are legion.

Ponhaws or *panhaas*, more familiar to most of us as scrapple, was once a by-product of winter butchering but now is generally available the year round. Thrift motivates the making of scrapple, for in slaughtering nothing must be wasted. The base for scrapple is the liquid left in big kettles after scrap meats and internal organs have been cooked. Before it cools and solidifies, the liquid is extended by adding scrap meats and,

usually, cornmeal and buckwheat flour, though some cooks prefer only cornmeal. The result is a product much like mush. Another by-product is *zitterli*, or souse, which is made from the meat of pigs' feet that is boiled, shredded, pickled and molded.

Herbs were an important part of the Pennsylvania Dutch cuisine and every housewife had her own garden where she tended her favorites such as sweet marjoram, saffron, dill, coriander, sage, chives, mint and horehound. However, her choice was not limited to the confines of her own patch since many others grew wild in the woods and fields. Those, too, were gathered both for kitchen and medicinal use.

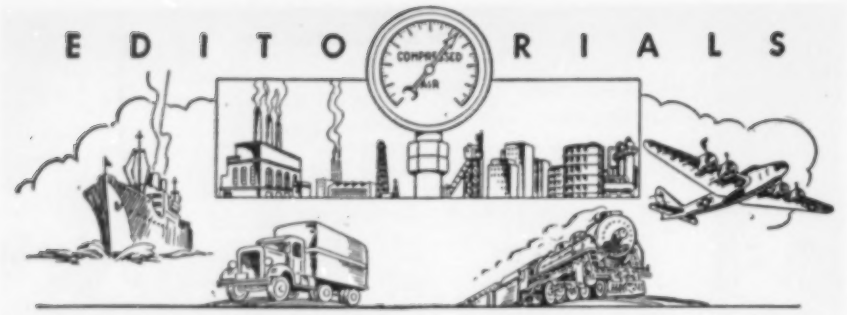
Aside from herbs, the frugality characteristic of the Pennsylvania German housewife led her to pick wild greens of which the best known today is probably dandelion. A salad of dandelion greens with a dressing of hot bacon and hard-boiled eggs is still a favorite of the "groaning" board in spring and heralds the change from the more limited winter menu. Other salad greens gathered in the fields included sorrel, water cress and wild lettuce, while dock, purslane, nettles, pokeweed, burdock and plantain were pulled to serve as potherbs for seasoning food.

Slightly moist, perhaps, but still a Pennsylvania Dutch custom, is dunking with friends, which is comparable to the English cup of tea. Banishment from polite society is no longer the punishment meted out to dunkers, for whom the women of that region prepare such goodies as shoofly pie, doughnuts, crullers and coffeecake. In fact, the custom has been so widely accepted that a nation-wide association of dunkers was organized some years ago and its members now number in the millions.

The women responsible for the high reputation won by Pennsylvania German cooking in this country were not deterred in their efforts by the disadvantages of kitchens in which most of today's housewives would probably refuse to work. All the good dishes for which the region has become famous were made without benefit of the grocery store around the corner or the deep freezer in the cellar. Heavy cast-iron pots and pans were the rule, and everything prepared on the stove needed one or more of these utensils before it was ready for the table. Gathering together the ingredients meant many trips from kitchen to springhouse, smokehouse, buttery, cellar and pantry, and the only automatic dishwasher was the daughter of the family.

FOOD, DRINKS AND FUN

The early settlers usually mixed work and fun. For example, making apple butter was not considered a chore. Even the young folks enjoyed themselves between turns at stirring the toothsome spread in the huge iron kettle. Whenever the men gathered for a little relaxation and singing, the Schnitzel Bank chart (top) was almost certain to appear. (These pictures were drawn by Edward C. Smith to illustrate two of a series of advertisements for Old Reading Beer under the general theme "Traditionally Pennsylvania Dutch." They are used through the courtesy of the Ted Black Agency, advertising firm in Reading, Pa.)



BOUNTIFUL SUGAR

THE family of substances known as hydrocarbons is amazing because of the multiplicity of things that can be derived from it. In the skillful hands of chemists, the molecules are torn apart and rearranged in countless ways. Some of the new combinations are themselves intermediates that are broken up, in turn, and reassembled in still different forms.

The first great hydrocarbon to yield innumerable products for use in the arts, industries and medicine cabinets was coal tar. Before World War I, German technologists explored its possibilities intensively and ere long Germany was supplying much of the world with dyestuffs and many other essential coal-tar derivatives. When the United States got into the conflict our source of these things was suddenly cut off and our chemists were obliged to discover, in short order, their own methods of producing them. That they did, and their efforts provided the nucleus for a fledgling industry that has become one of great and continually growing importance. If the war had not been waged and if we had not taken part in it, no one can say what our position in the realm of organic chemistry might be today. As it is, we are self-sufficient in that field in peace or war.

In recent years a new word, petrochemicals, has entered the nomenclature of chemistry. It designates a long list of substances that are obtained in great quantities from petroleum or natural gas. Some of them are the same as the coal-tar derivatives and others are different. Expenditures for petrochemical plants, chiefly in the Gulf Coast area, have exceeded a billion dollars in the past decade.

Now the busy research men have unearthed still another potential source of chemical building stones with which they can assemble numerous useful products. It is one of man's oldest and most popular foodstuffs—sugar. Like coal tar and petroleum, it is a hydrocarbon, and any high-school chemistry student can give you its formula. Unlike them, it is found in growing things. It can be obtained from either cane or beets, plants that are raised well-nigh universally, for there is hardly a country that does not cultivate one or the other. In peacetime there is generally an oversupply of sugar, so planters and processors will welcome an additional outlet for it.

Developments and prospects in this promising field were outlined recently before the American Chemical Society by Dr. Henry B. Hass, an organic chemist who heads the Sugar Research Foundation, an industry-sponsored organization. So far, he reported, not many establishments are using sugar as a raw material but they are, nevertheless, turning out a wide variety of products.

The Atlas Powder Company, for instance, has developed a commercial process which will enable it to obtain two alcohols—mannitol and sorbitol—from sugar and convert sorbitol into glycerine. The concern wants this end product primarily for the making of explosives, but glycerine also enters into scores of other articles of commerce including cosmetics and tobacco. Atlas plans to build a $10-million sorbitol-conversion plant.

Similarly, the Great Western Sugar Company, the nation's largest and first processor of sugar beets, will put a new $3,000,000 factory in operation this year to turn out monosodium glutamate, a flavor-enhancer for foods that the housewife knows by simpler trade names, one of the more popular of which is Accent.

In the hands of other concerns sugar is the starting point in the production of blood-plasma extenders, emulsifiers, adhesives that cause insecticides to stick to plants, detergents that may cost less than those now on the market, and materials that give plastics their flexibility.

After the sugar-bearing juice is extracted from either cane or beets much refuse remains, and that from beets, which is highly nutritious, has long been the basis of feed for sheep and cattle. In like manner molasses, a by-product of all sugar refineries, is converted into livestock feed, although much of that obtained from cane winds up in bottles in the form of rum.

Bagasse, the shredded residue of cane stalks, is being processed into various grades of paper and paperboard. In the Dominican Republic, a $7,000,000 factory will shortly be using it to make furfural, and most of the output is scheduled to go into the production of nylon in the United States. A natural wax that coats the outside of sugar-cane stalks is carried over into the bagasse. It has some of the desirable properties of carnauba wax, which is obtained from certain palm trees. The Sun Chemical Corporation is recovering the cane wax and utilizing it in the making of various polishes. And a leading manufacturer of phonograph records coats its disks with a protective resin that originates in bagasse.

Thus sugar is rapidly becoming more than just a sweetener and a principal ingredient in confections that are the delight of children and the despair of adults plagued with too much weight. It is said that sugar compares favorably in cost with other raw materials of the organic-chemistry industry and that the world output of cane and beets could easily be doubled. Currently, about 60 percent of all refined sugar comes from cane and the remainder from beets. Contrary to a rather widely held belief, the two products are identical.

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OVERLOOKED BRAIN POWER

LARGE industrial concerns that are in the habit of filling supervisory positions almost entirely with college graduates may be overlooking capable people among their lesser-educated employees, according to Dr. E.L. Stromberg, manager of training and personnel for The B.F. Goodrich Company. Many of the latter, he contends, are mentally capable of being developed so they can assume responsible posts, and failure to do that constitutes "a waste of brain power."

"Among men and women who make up industry's physical manpower resources," he said, "are many who, if given the opportunity, could . . . carry out assignments now classified as jobs for college graduates." He is of the opinion that many of them had the ability to go through college but decided against spending four or more years there because they didn't think the prospective financial rewards in white-collar management positions were attractive enough to warrant it. He also believes that lots of college graduates are "underjobbed," that is, they are capable of taking on greater responsibilities and would be happier and more productive if given duties more challenging to their mental faculties.

Better utilization can be made of the available manpower, he states, by continually reëxamining the mental resources of each worker. Many of them will be found ready for bigger jobs and will respond to promotion. On the other hand, they may, if kept at simple tasks, become bored and disinterested and eventually seek more satisfying work.

400 FIRMS EXHIBIT INSTRUMENTS

THE First International Instrument Congress and Exposition held recently in Philadelphia, Pa., gave 20,000 visitors a small preview of the era of automation. More than 400 exhibitors, including 74 from foreign countries, displayed $10 million worth of pneumatic, electronic and ultrasonic devices ranging from simple pressure gauges to complex computers for offices. The event was sponsored by the Instrument Society of America, which had invited seventeen other organizations to participate in the presentation of technical papers during a 12-day session. The following notes relate to a few of the exhibits that were of general interest.

Diamond Power Specialty Corporation's industrial television equipment was not only shown but also served useful purposes at the exposition. Several of its Utiliscope monitors were stationed at strategic points around Convention Hall and persons, who were not immediately available when messages arrived for them, were paged by putting their names on the screens. In one instance, this saved time in locating a man whose wife had been suddenly hospitalized.

A representative of the company stated that its interest in television developed because it makes water-level gauges for boilers and it was desirable to have some means of watching them from remote locations. One concern, Dayton Power & Light Company, of Dayton, Ohio, has ten Utiliscopes in service and five of them are monitoring boiler gauges. The sets now sell for a little more than $3000, a sizable reduction from the price charged two or three years ago.

The Minneapolis-Honeywell Regulator Company exhibited its Sea Scanar, an ultrasonic, underwater echo-sounding device that harnesses high-frequency sound waves to probe the depths. Like a searchlight, it scans any object beneath the surface of the sea at depths and distances forward, backward or laterally up to 1600 feet. It assists in locating schools of fish, whales and sunken ships.

Among the various instruments shown for measuring air at pressures both above and below atmospheric was a Hastings Instrument Company meter. The latter serves to record the velocity of an air stream and is claimed to be accurate and sensitive enough to indicate the speed of smoke rising from a cigarette. It reads directly in feet per minute on a logarithmic-type scale.

To demonstrate one of its devices under operating conditions, Bristol Company, of Waterbury, Conn., leased a 20-mile telephone line extending into the display space. A 24-inch dial of a Metameter telemetering system showed the pressure of natural gas being delivered by pipe line to the Sun Oil Company's Marcus Hook Refinery outside of Philadelphia. A transmitter measured the pressure and converted it into electrical impulses, which were sent over the wire circuit to a receiver. At Marcus Hook, the receiver is located only a few thousand feet from the measuring station, but the distance could be 100 times as great.

FLIGHT SECRETARY

Produced by the mechanical division of General Mills, Inc., this instrument provides a continuous record on a strip of aluminum foil of 300 hours of plane flight, including direction, speed, vertical acceleration and altitude. Its original purpose was to provide essential flight data usually missing after a plane crashes, thus, in many cases, revealing the cause of the accident. The flight recorder, as it is known, contains no electronic tubes to fail and can withstand a temperature of 2000°F.

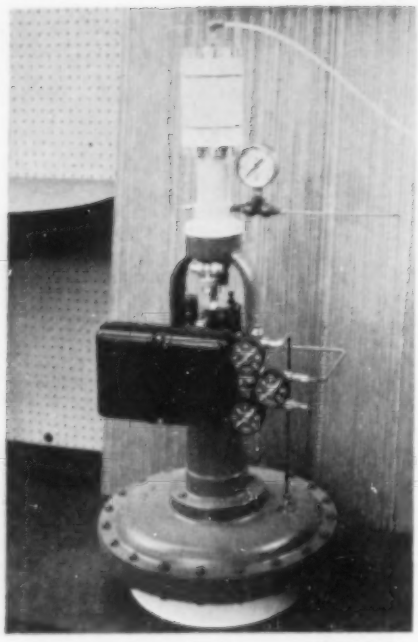
Another Bristol instrument, called the Metaphone, makes it possible to obtain the pressure in an unattended gas holder by telephone. When someone dials the allotted number and opens the transmission circuit, a buzzer sounds for an interval that is determined by the pressure in the holder. By timing this signal with a stopwatch the caller gets the desired information. For example, if a gas holder that normally operates at 300 psi pressure is down to 200 psi the buzzer sounds for 40 seconds and is quiet for 20 seconds and this sequence is repeated over and over.

Also among the exhibits was a wax-covered paper for recording charts that is more than 40 years old but still new to some instrument people. It has long been used by a few concerns, including General Electric Company (on demand meters that measure the amount of electricity sold for power purposes), but has never been generally advertised until recently. Called Waxon, the paper is manufactured in any one of eleven colors by Waxon-Carboff, Inc. Among the advantages claimed for it are that failure to register because of ink-clogged pens is obviated and that records inscribed on a wax film are tamperproof. Once a line has been drawn, it can't be changed without destroying it. The coating melts at 140°F, which makes it suitable for about 99 percent of all graphic recording services.

American Cystoscope Makers, Inc., showed industrial devices that are a de-

LEARNING HOW IT WORKS

Many of the exhibitors set up their instruments so that they could be demonstrated. Shown is part of a panel of controllers in the Leeds & Northrup booth.



HAS WIDE RANGE

This new controller, made by Fisher Governor Company, of Marshalltown, Iowa, will maintain the flow of extremely small quantities of air or gas with exactness regardless of fluctuations in the outlet pressure.

velopment of the firm's long-established line of instruments for physicians and surgeons. They are all variations of industrial telescopes to which the name Borescope has been given. Consisting of telescopic tubing with an eyepiece at one end and an electric bulb and right-angle lens at the other, the instrument permits visual inspection of the interiors of many machines, especially of parts of airplanes such as engine cylinders and hollow propeller blades where it is highly important that defects be detected without delay. It is also used in foundries to check the inner surfaces of castings for flaws, in machine shops to inspect inaccessible cavities such as bore holes, and in chemical plants for examining the interiors of boiler tubes and distillation apparatus.

S. S. White Dental Manufacturing Company displayed a small abrasive, air-blast unit that may be useful to instrument makers for some of the fine and accurate cutting work they have to do. The unit is an outgrowth of the equipment the firm recently introduced for use by dentists in place of conventional drills. Called the Industrial Airbrasive unit, it utilizes aluminum oxide reduced to an average particle size of 27 microns (approximately 1/940 inch). The mixing chamber holds 11½ ounces, or enough for an hour under normal conditions. Carbon dioxide usually serves as the propellant because it is readily available in cylinders, but either nitrogen, if dry, or compressed air, if dry and oil-free, will do. Gas consumption ranges around 20 cubic feet per hour, at which rate a standard 425-cubic-foot cylinder of carbon dioxide will last 21 hours.

The velocity of the stream of abrasive leaving a standard 0.018-inch-orifice nozzle with 75 psi gas pressure behind it is believed to be about 1100 feet per second (12 miles per minute). For making unusually fine cuts, down to 0.008-inch wide, a nozzle with a 0.006x0.060-inch rectangular opening is used. Blasting does not generate as much heat as some other methods and is faster in some instances.

A display arranged by the Franklin Institute, of Philadelphia, perhaps startled a few visitors who hadn't thought much about the lubricating properties of air. Although the idea is not new (someone conceived it 50 years ago), air-lubricated bearings have only lately been considered for industrial application. They are now found in food processing machinery, thread and textile machines and in chemical equipment where oil or grease might soil or contaminate the product; in machinery operating at speeds as high as 100,000 rpm and requiring low-friction bearings; and in machines where high temperature causes standard lubricants to evaporate. The exhibit was composed of journal, thrust and ball bearings riding on a film of air and was designed to show the latter's advantages as a lubricant. Among these are unusually low starting friction and running drag, good load-carrying capacity, and absence of dirt or contamination.

The Atomic Energy Commission had a display of surprising size. The Commission got into the instrumentation field of necessity during World War II because its work was highly secret and it was not possible, in any event, to obtain quickly the instruments it needed for the intricate processes at Oak Ridge, Tenn., and elsewhere. Its technologists still design instruments for various purposes, but the current policy is to let private concerns make them.

Inspired by the atomic-energy program is a mechanical arm that is designed to avoid human exposure to radiation or to such hazards as explosions in chemical and powder factories. Driven electrically, it provides motions corresponding to those of the shoulder, elbow, wrist and hand. The latter has a gripping force of 150 pounds and the arm can lift a load of 750 pounds vertically. The robot was exhibited by the Mechanical Division of General Mills, Inc.

The instrument business has grown large enough to support some subordinate ones. Among them is a sizable enterprise devoted entirely to packaging instruments which must be protected in transit against shock, vibration, humidity and temperature. Because they are, for the most part, delicate and fragile they must be handled with special care and Cargo Packers Incorporated showed materials, equipment and techniques designed to safeguard them during shipment. It also packs instruments for manufacturers in accordance with the latter's specifications. The concern gained valuable experience during the recent war by performing the same service for all branches of the armed forces. This involved packaging electronic, photographic and aviation equipment and various instruments for delivery to all parts of the world.

SENSITIVE MEASURING EQUIPMENT

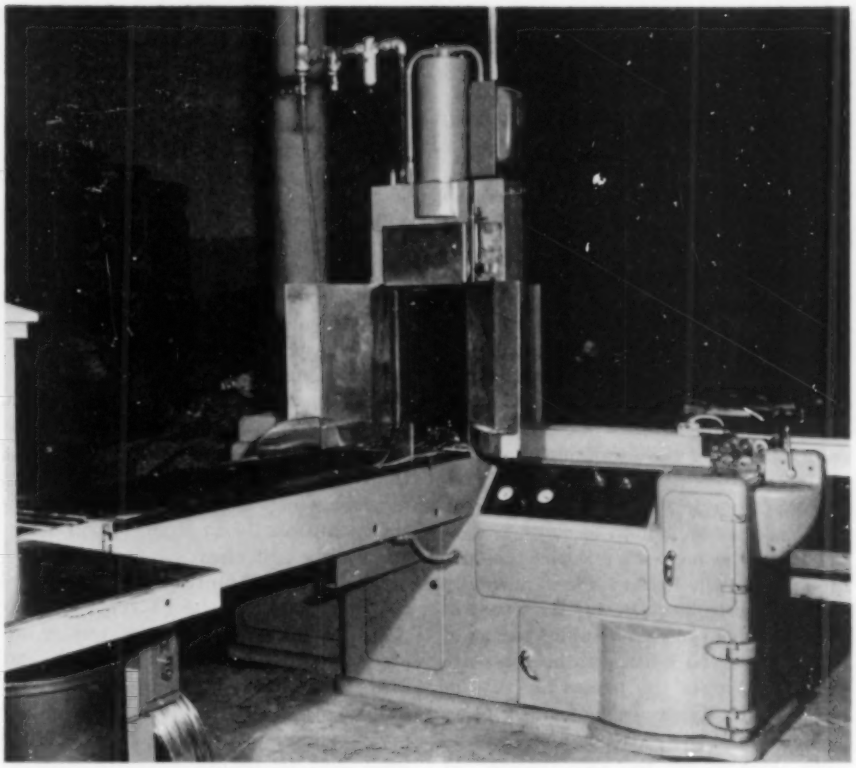
To meet the need of instruments for its secret wartime program the Atomic Energy Commission got into the field of instrumentation in a big way. Its technicians still design a lot of such equipment, but most of it is manufactured by private industrial firms. Dr. James E. Hudgens, chief of the radiochemistry branch of the AEC laboratory at New Brunswick, N.J., is shown beginning a determination of radon, the heavy gas given off by radium. The apparatus can measure the concentration of radon in a piece of ore or in a man's breath.

Newspaper Bundler Works Fast

NEWSPAPERS are run off at the rate of a ton of paper every three to eight minutes, far faster than it has been possible to bundle them for distribution by the customary method. To put that work on an equally speedy footing, the *Toronto Star*, which has for years conducted research in an attempt to develop equipment that would both lower costs and simplify the diversified operations, has designed a pneumatic bundler.

According to T. R. Sykes, manager of the *Star's* research and engineering department, "Air is used to power many of the motions on this equipment (known as the Wallastar Bundler) for several reasons. A 100-psi system will develop the required forces when using cylinders of optimum size. The high speed which is essential, can be achieved with air by valves and piping of reasonable size. Air motions are readily controlled with electrically operated valves. Also using a central compressor station of adequate capacity permits installation of as many machines as desired."

The unit works automatically and consists of a main pneumatic cylinder which compresses stacks of papers and of wire-feeding, cutting and welding mechanisms. After a bundle is compressed, the wire is fed beneath it and cut off by air power. Then folder arms, actuated by auxiliary pneumatic cylinders, wrap the wire around the package. When these arms reach the top of their stroke, two other auxiliary cylinders go into action to do the welding and to flatten the joint.



AIR-POWERED NEWSPAPER BUNDLER

With this pneumatic machine, developed among others by the research department of the "Toronto Star," the time lag between printing and getting the papers ready for distribution has been reduced to a minimum. One of the unusual features of the automatic press is a patented 3-poppet air-saver valve. By means of this device, the air used on the operating stroke of the main pneumatic cylinder is partially exhausted and stored in a receiver at the opposite end to actuate the piston on the less powerful return stroke. This takes place when the remainder of the air admitted at the intake end has been exhausted to atmosphere.

The Wallastar is served by a conveyor that is equipped with a pneumatic clutch and stops. Compressed air also powers a lift table and a bundle positioner through pneumatic cylinders. All the operations involved make for an exceptionally fast cycle during which up to 26 stacks are tied, each with a single wire, in one minute, it is said. More than 25 newspapers now use the new equipment.

Film Available of Epic Alcan Tunnel Job

THE story of Alcan's power tunnel at Kemano, B. C., is recorded in an action-packed color film, entitled *Breakthrough*, produced for Canadian Ingersoll-Rand Company, Ltd. The 32-minute, 16-mm movie with sound sets forth in a concise manner the story of modern hard-rock tunneling with heavy air drills using Carset (tungsten-carbide insert) Jackbits as exemplified in Aluminum Company of Canada's vast hydroelectric project in the rugged, isolated coastal Rockies north of Vancouver.

Some 2,300,000 tons of rock was drilled, blasted and mucked from the heart of the mountain range to shatter world tunnel-driving records. Water for the 25-foot-diameter 10-mile bore will come from a 358-square-mile reservoir with a capacity of some 873,000 million cubic feet formed by the world's largest rockfill dam which blocks the eastward flow of the Nechako River. It will enter the tunnel at the lake's western end and drop 2600 feet into Alcan's powerhouse occupying a chamber as high as a 14-story building and 700 feet long carved out of solid rock. The electricity generated there will be transmitted 50 miles to Kitimat, the tidewater site of Alcan's new aluminum smelter.

The day-by-day life and work of the construction workers are pictured, as well as the drilling of blastholes with air-powered machines; loading holes with dynamite and firing them; removing broken rock with power shovels and dumping it into trains of cars; and shifting muck cars by means of "cherry-pickers." The movie is a tribute to the men who visualized and achieved this tremendous goal and to the equipment without which their objective could not have been attained.

The film is available without charge for showing by interested groups such as mining, construction and educational organizations. Residents of the United States may address requests for it to the Advertising Division, Ingersoll-Rand Company, Phillipsburg, N. J. Others should address Canadian Ingersoll-Rand Company, Ltd., 620 Cathcart Street, Montreal 2, Que., Canada.

Helium Curbs Hydrogen

PURGING hydrogen lines with inert helium is the basis of a method that has been devised to eliminate the formation of explosive air-hydrogen mixtures in places where that gas serves industrial purposes. The inventor is R.M. Carson, formerly of the National Bureau of Standards staff and now with the Diamond Ordnance Fuse Laboratories, Department of Defense.

The use of hydrogen in heat-treating and brazing processes is common practice and presents an inherent explosion hazard, especially if it is piped from a reservoir to various working stations. In the case of one procedure the gas is allowed to flow into an enclosure such as a bell jar and to escape thence into a room.

Safe operation depends on keeping hydrogen above atmospheric pressure and maintaining a continuous outward flow. If its pressure falls below that of the atmosphere, air and hydrogen will mix. When the percentage of hydrogen is anywhere within the range of 7 to 73 percent, an explosion can occur if the temperature rises to about 500-600°C (932-1112°F).

Although differential pressure controls and relay devices will automatically indicate a pressure change, they are not safeguards against possible explosions in the operating chamber. In Mr. Carson's system, helium is used to purge and flood the hydrogen lines automatically to prevent the admission of outside air in case the internal pressure falls below atmospheric pressure.

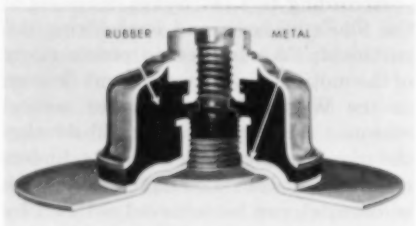
A cylinder of helium is connected in the hydrogen network and the pressure regulator in the helium line is normally set from 10 to 20 psi lower than that in the hydrogen system. Helium begins to flow only if the hydrogen-line pressure drops to that of the preset pressure of the helium. The hydrogen remaining in the system is then rapidly expelled and fully replaced by the safe helium. A hazardous mixture of air and hydrogen is never allowed to accumulate.

The safety feature is being used successfully with hydrogen furnaces, radiant ovens and radio-frequency heating setups and with devices and components treated in hydrogen-filled enclosures.

Oscillator for Smoother Disk Grinding

WHY didn't some one think of it before? That question might well be asked in the case of the Flexentrik Oscillator, a simple device that, from all accounts, has taken the bugs out of mechanical disk grinding, sanding and polishing operations. It is a balanced, free-floating head of specially compounded heat-resistant rubber that is interposed between the power unit and the abrading or buffing disk and acts not only as a vibration dampener and shock absorber but also permits full-face contact of the disk with the work without torque, jerking or grabbing. As a result, pressure is exerted over a larger than normal area, and the oscillatory motion, which causes the abrasive particles continually to change their path, throws the grit clear.

By always presenting a clean surface to the work, says the Flexentrik Company, the new system produces a lap grind and lessens clogging, filling and disk wear. It is also said to eliminate grinding rings, scoring, digging, grooving and burning; to prolong the life of the tool; and to reduce operator fatigue. The head is available in sizes to fit all standard motor shafts and for general service with coated abrasive disks, for light-duty sanding (woodworking) and polishing, and for heavy-duty work with wire brushes, cup wheels and raised-hub disk wheels. Backing and cushioning pads are provided. The oscillator is distributed by J&H Products Company, Inc., 3007 Elm Street, Dallas, Tex.

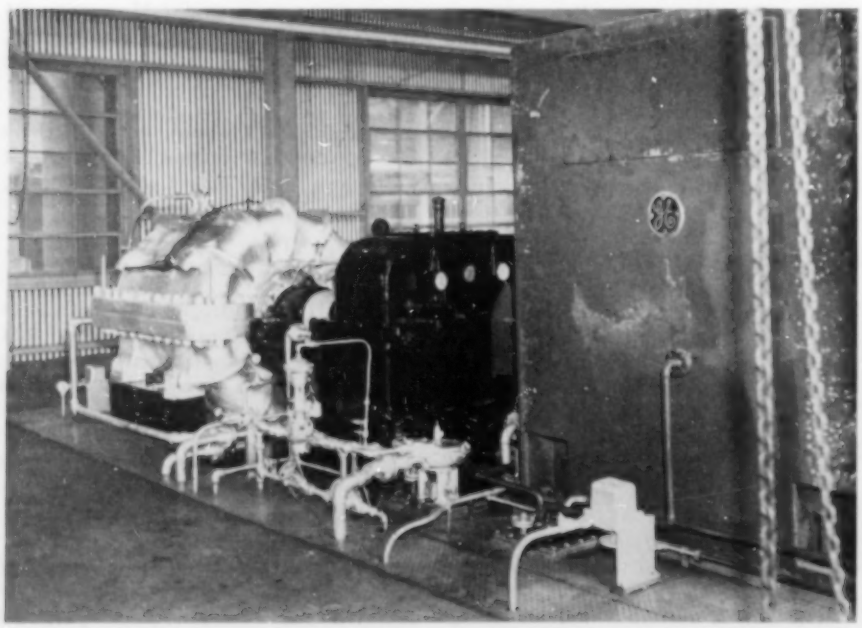


CROSS-SECTIONAL VIEW

Interposed between the tool and the disk, the free-floating head or oscillator (top) serves as a cushion that makes for smooth operation and reduces worker fatigue. It permits featheredging without the use of special devices.

World's Largest Gas-filled Motors Drive Centrifugal Compressors

TWO of the world's largest totally enclosed gas-filled induction motors were installed recently in the Esso Standard Oil Company's refinery at Everett, Mass. Built by the General Electric Company's Medium Induction Motor Department, they are rated as 3000-hp, 1800-rpm, 2300-volt, 3-phase, 60-cycle units and are used to power Ingersoll-Rand centrifugal compressors. Designed especially for application in hazardous locations, the machines are fitted for this service by maintaining clean, dry, oil-free air of instrument quality at a pressure slightly above atmospheric inside the motor enclosures.



BIGGEST OF ITS KIND

One of two turbocompressors each driven by a 3000-hp motor that is protected against explosions. This one handles gas. The 6-stage blower is at the left. Next to it is the driving-gear assembly and at the right the boxlike casing inside of which the motor runs in an atmosphere of inert gas.

One of the units drives an Ingersoll-Rand 3-stage blower rated at 39,100 cfm at 17 psi pressure. The blower operates constantly at 3800 rpm and is fitted with a power wheel for operation at less than rated capacity. The other motor powers an Ingersoll-Rand 6-stage centrifugal compressor rated at 13,400 cfm at 108 psi pressure. This blower operates at 6900 rpm and, like the other, is driven through step-up gears.

Both units were installed at the Esso refinery by Foster Wheeler Corporation. The first compressor has impellers 47 inches in diameter and serves as the main air blower in the plant. The second one, with 26-inch impellers, is used for compressing gases. The first inert-gas-filled motor for hazardous applications was built, also by General Electric, in 1932 and had a rating of 100 hp at 277 rpm.

This and That

Chicken Feather Brushes

Something stranger than turning sows' ears into purses is emerging from the laboratory. A new synthetic fiber derived from chicken feathers promises to provide paint brushes that will be as good as those customarily made from Chinese hog bristles now hard to get because of Russian influence in the Orient. The material is the protein Keratin, which is also found in wool, hair, fingernails and the outer layers of skin. Extracted from feathers by chemical means, it can be tapered (natural bristles are already tapered), a property that makes it superior to other substitute bristles.

The U.S. Department of Agriculture discovered how Keratin can be obtained from feathers in the form of a cream-colored, insoluble powder. This is converted into fine threads by first softening it with chemicals and then, with the aid of heat and pressure, forcing it through tiny openings in a metal plate. These fibers are originally soft, but are hardened and toughened by subjecting them to a series of chemical baths.

Research with the new bristles is being conducted by Rubberset Company in conjunction with the industrial consulting firm of Arthur D. Little, Inc. It is still in the pilot-plant stage, and no date has been set as to when the new brushes will be put on dealers' shelves.

★ ★ ★

Franklin Zinc Mine Closed

A few weeks ago the New Jersey Zinc Company's mine at Franklin, N. J., within an hour's drive from New York City, ceased operation for all time, its ore exhausted after more than 100 years of steady production. The Franklin, originally known as the Mine Hill, and its companion property, the Sterling Mine at nearby Ogdensburg, were the nation's first sources of zinc. Their black, red and green ores, a mixture of three oxides (franklinite, zincite and willemite), are distinctive of the area. Franklinite, a jet-black oxide of zinc, iron and manganese which obtained its name from the locality, has never been found in abundance elsewhere.

Evidence indicates that Dutch settlers discovered these two unique deposits within a short time after Henry Hudson first sailed the *Half Moon* into New York Harbor in 1609. Unable to identify the minerals and therefore not knowing what useful purpose they might serve, the prospectors pressed on westward to the Delaware and there, a few miles above the famous Water Gap, began mining low-grade copper ores in 1620. Because of downstream rapids, the Delaware was not navigable, and so, in order to get the ores out and on their way to the home country, the Dutch built America's first road of consequence. It extended from the workings to the present site of Kingston, N. Y., on the Hudson River.

William Alexander, the Earl of Stirling, inheritor of the lands on which the zinc deposits were located, tried shortly after he came to America in 1760 to reduce the ores to metal, but was unsuccessful. From him one of the mines acquired its name, which has since then undergone a slight change in spelling. Following him, Joseph Sharp and Dr. Samuel Fowler likewise failed, in turn, to find a way of smelting the complex mixture; in fact, all the early owners of the properties thought the black franklinite was an iron ore, perhaps similar to the magnetite that occurs extensively near Dover, N. J. Doctor Fowler did, however, grind some of the zinc oxide into a bluish-white powder and used it in place of white lead to make house paint. That was the first application of domestic zinc for that purpose. In addition, some of the red oxide was alloyed with copper to make brass for a set of standard weights specified for use in the Government's customhouses according to a law enacted by Congress while Doctor Fowler was a member of that legislative body.

Steady mining of the deposits began about 1831 when the opening of the Morris Canal between the Delaware and Hudson rivers solved the problem of transporting the output to tidewater. In 1848 a group that included Doctor Fowler's son, Col. Samuel Fowler, formed the Sussex Zinc & Copper Mining & Manufacturing Company. At first, zinc oxide was the only product and zincite was for a long time believed to be the only valuable constituent of the ore. But in 1888, after years of effort, John P. Wetherill discovered a method of separating the three minerals and extracting their zinc content.

Meanwhile, inability to determine the exact nature of the ores had led to legal complications, for Colonel Fowler had conveyed two titles to two separate groups. One covered the zinc ores and the second the franklinite "and other iron ores." That brought on litigation which continued for 40 years until the conflicting parties were brought together in 1897 and organized the New Jersey Zinc Company. From then on the singular red, green and black ores were mined continuously and constituted the nucleus that led to the owning company's expansion into a leading factor in the nation's zinc industry. Until a few years ago the New Jersey district was the country's third largest zinc producer.

When the ore in the Franklin Mine began to peter out some years ago it became apparent that a shutdown could not be long averted. However, that had been predicted so often without coming true that the people of the district began to laugh off the threat. Time after time additional deposits had been turned up by the engineers to keep the property going, and it was assumed that that would continue to happen. It didn't though, and shutdown in September came as a shock. The mine had distributed $75 million in wages alone during the past 30 years and was the area's economic and taxpaying mainstay.

Only a "cleanup" crew of about 100 men is now working at Franklin, but the Sterling Mine at Ogdensburg will not close; in fact it is being expanded by sinking a $3,000,000 shaft that is scheduled to go into service in 1956.

★ ★ ★

Curiosity Seldom Kills Cats

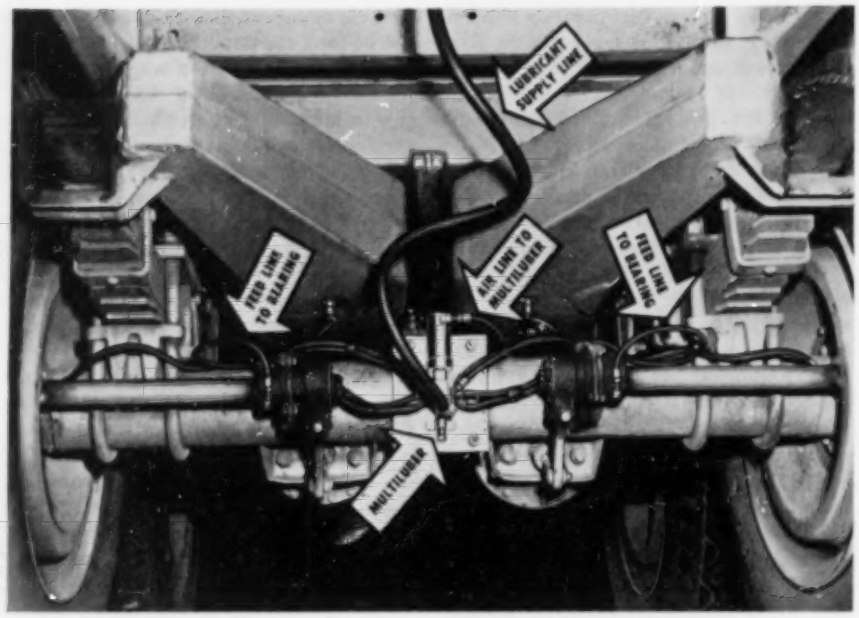
A writer named Garry Flinn recently had a nice little human interest story in the *Newark Evening News* about curiosity and cats. The gist of the tale was that curious cats continually court trouble but are usually saved from sacrificing one of their nine lives by soft-hearted humans. The piece was prompted by a prowling mother cat and kitten that got themselves concreted underneath a Brooklyn pier while investigating the rat population. A day or two later when the concrete had hardened they made their presence known by yowling, and a crew with an air-operated paving breaker punched a hole in a wall to extricate them. True to the characteristics of the breed, the rescued felines did not tarry to tender thanks but scampered off.

★ ★ ★

Air Line on Coast Bridge

Special arrangements for maintenance are included in the $62-million Richmond-San Rafael toll bridge being built across the northern part of San Francisco Bay and now about one-quarter completed. Much study has gone into making all the structural members easily accessible for cleaning and painting and into providing suitable service facilities for those purposes. These include a 4¼-mile-long, 2½-inch air line that will extend the length of the bridge and connect maintenance buildings at opposite ends. Each of the structures will contain an electric-driven compressor regulated so as to start when the pressure in the system falls below a certain level and to stop at a specified upper limit. The air will be used for sandblasting and spray-painting and for operating foghorns.

Industrial Notes

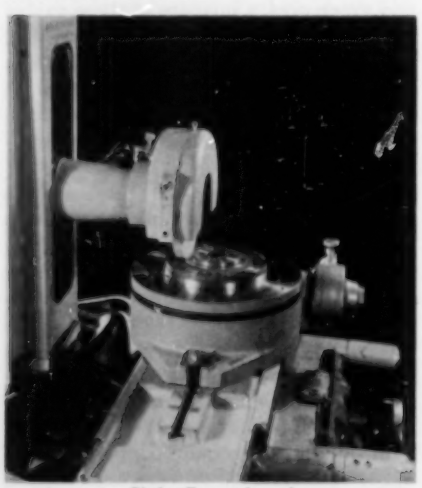


A device has been developed that is said to make it possible automatically to lubricate any truck trailer equipped with pneumatic brakes. Called Multi-Luber by its manufacturer, the Lincoln Engineering Company, it is a centralized and simple yet dependable system of feeding a measured amount of oil to various points in the running gear. Essentially a modified single-acting air cylinder, it can be installed, as shown, by any mechanic and is connected to the vehicle's air-brake line so that it is actuated every time the brakes are applied. The cylinder moves a rod with an orifice past twelve oil ports in sequence, forcing into each approximately 0.002 ounce of lubricant. If there are more than that, two Multi-Lubers are used; if less, the excess openings are blocked. Tubing extends from each port to a lube reservoir, and as only one port is open at a time a broken line does not affect lubrication of the other points. The device can be obtained in kit form for all makes and models of trailers and comes complete with flexible or rigid tubing, clamps, nuts, bolts and an oil receiver. The latter has a capacity of 4 gallons, enough for about 5000 to 7500 miles of operation, and normally needs to be filled only at 30-day intervals.

Circle 1E on reply card

Thomas W. Pangborn founded the Pangborn Corporation in 1904 and was still head of it in September of this year when it observed its fiftieth anniversary. It is said that this has seldom if ever before transpired in American industry. The Pangborn organization, with headquarters in Hagerstown, Md., has always specialized in sand- and metal-blasting equipment for cleaning purposes and now has more than 28,000 machines in service.

A portable rotary table that serves two functions has been announced by The Vulcan Tool Company. It may be used either in surface grinding flanged studs or bushings, bearing spacers, forming rolls (angle or radius), convex or concave surfaces, etc., or, with lapping plates designed for it, as a bench-type lapping machine. Precision built throughout, the unit is rotated by compressed air at variable speeds ranging from 40 to 100 rpm. With it, only the grinder's cross feed is utilized, thus reducing machine error and saving time in producing fine micro finishes. The table may be used on a sine plate or angle fixture with a standard surface grinding wheel, eliminating the need of dressing large external wheels for side grinding. It is available in sizes ranging in diameter from 6 to 10 inches.



Circle 2E on reply card

In 1953 a leading Design trade magazine conducted a survey among 1902 manufacturing plants on the use of Internal Combustion Engines of less than 60 hp., as power components in equipment made for resale.

Projected returns from 42.6% of plants contacted showed an estimated 678 plants using engines in the stated category, representing total engine purchases of 2,727,216.

Answering the question: "Who makes the Internal Combustion Engines you Use?" . . . Wisconsin Motor Corporation received 132 mentions, as against 105 for the second place builder, 56 for No. 3, 51 for No. 4—in a list of 41 classified engine manufacturers.

This outstanding preference for Wisconsin Heavy-Duty Air-Cooled Engines (although limited to a power range of 3 to 36 hp. in a broad survey classification including ALL engines below 60 hp.) provides tangible evidence that "WISCONSIN" rates first among men who know engines best. We'd like to count you among them.

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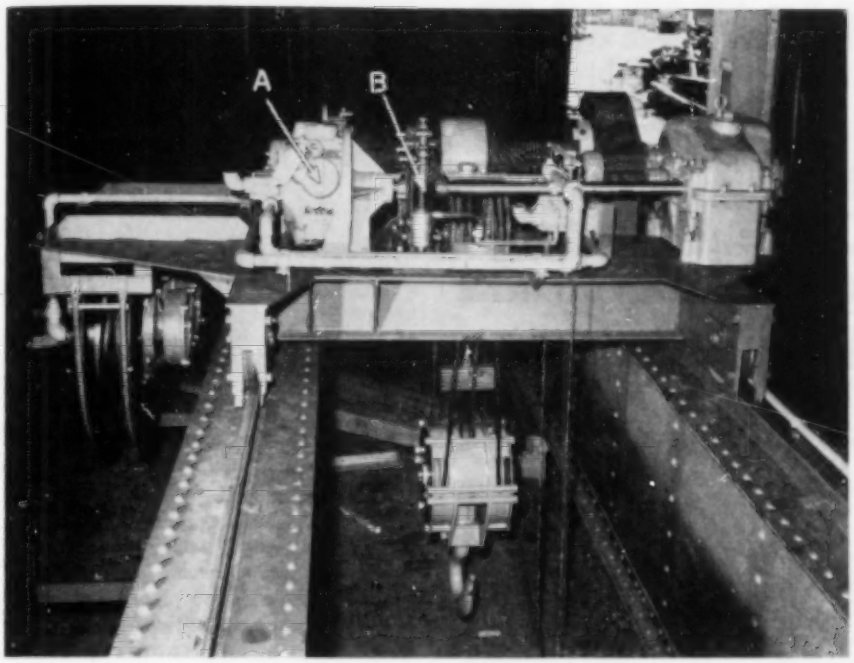
Circle 17A on reply card



SAFETY FIRST

The explosionproof crane in the exhauster and booster building of United States Steel Company's Morrisville by-products plant. It has a span of 52 feet and features two Ingersoll-Rand air motors: one for hoisting and the other for crane travel. Only one is visible, the KK5M that handles the loads (indicated by A). Right of the latter and directly on the drive shaft is an automatic air brake (B) that replaces the solenoid-operated unit normally used with electric motors. The KK5M is remote controlled so the pull chains can hang right down to the floor.

Cranes equipped with air instead of electric motors are being built by The Euclid Crane & Hoist Company for operation in explosive atmospheres. There are many plants where heavy handling must be done in areas where dust and certain vapors and gases may accumulate in sufficient quantities to create an explosive mixture that may be set off by even a tiny spark. It is to prevent disasters of this kind that Euclid is incorporating explosionproof motors in some of its cranes which, with that exception, are of standard design. One unit has been installed in the exhauster and booster building of the by-products plant of the new United States Steel Company's Fairless Works near Morrisville, Pa. It has a span of 52 feet and a carrying capacity of 16 tons and is provided with two air motors. Another similar crane has been in service for more than 2 years in the Middletown, Ohio, exhauster and booster building of Armco Steel Corporation.

Circle 3E on reply card

For use where a minimum of oiling is needed, the Bijur Lubricating Company is offering a unit complete with reservoir, pump, filter and metering device that is smaller than a pack of cigarettes. It holds 20 cubic centimeters, and the pump can be adjusted to discharge 0.6, 0.45 or 0.3 cc when a plunger is pulled. There is a ⅝-inch-diameter window in the reservoir to check oil level. Known as the L Special, the system is designed especially for small machine elements and may be installed to discharge into tubes leading to the points of application or into passages drilled in the machine. In the latter case, up to four metering devices may be embodied in the lubricator to feed oil to bearings in whatever proportion each may require.

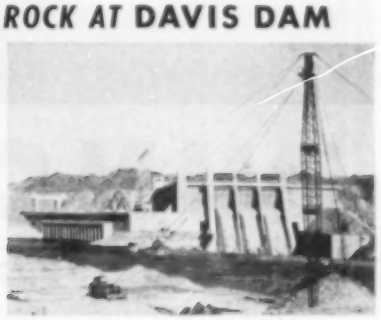
Circle 4E on reply card

Mo-Braze is the name of a high-temperature powder put on the market by American Electro Metal Corporation for brazing molybdenum to molybdenum, tungsten to tungsten or molybdenum to tungsten. The powder melts at approximately 3450°F and forms a continuous joint without oxidation of the parts.

Circle 5E on reply card

Congress Drives Division, Tann Corporation has announced a new line of standard pillow-block and flange bearings based on a new lubricating principle that is said to increase their service life and decrease maintenance. Known as Permawick, a name derived from a new wicking that is said to hold nine times its weight in oil, the lubricant is metered through the sintered-bronze bearing to the shaft in the proper amount and only as needed. The bearings themselves are prelubricated with oxidation-inhibiting oil at the factory. The pillow block is unique in design and interchangeable with similar types now in use. It consists of a precision-cast ball carrying the bronze bushing, an oil reservoir and cup.

"WALKING" CABLEWAY REMOVES 75,000 YDS. OF ROCK AT DAVIS DAM



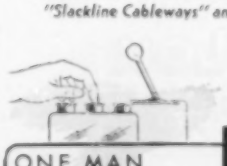
To deepen the Coloredo River from Davis Dam to 2,000 ft. downstream, Grafe-Callahan Construction Co., employed a Sauerman Slackline Cableway in this unusual arrangement:

Mast and hoist of the 2-cu. yd. machine were mounted on wooden mats. Only four "steps" were required in covering the 2,000-ft. distance as the excavation progressed. Maximum span was 600 ft. A crawler crane, running on a 30-ft. cofferdam on the opposite bank, served as tail anchor.

Total excavation was 75,000 yds. of rock. Excavation depth ranged from 10 to 15 ft. to provide the 20-ft. channel depth and lower tailwater at the power plant for maximum effective head on turbines.

Sauerman Slackline Cableways range from ½ to 3½ cu. yds. in size—span water, bogs or pits at distances up to 1,000 ft. On the ordinary or the unusual job, these Sauerman Cableways are unexcelled for deep digging or handling rock, sand, clay, peat and ore.

Experienced Sauerman Engineers can solve your excavating problems. Write today. Request Catalog C., "Slackline Cableways" and also pertinent field reports.



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FIRST in earthmoving equipment—chooses . . .

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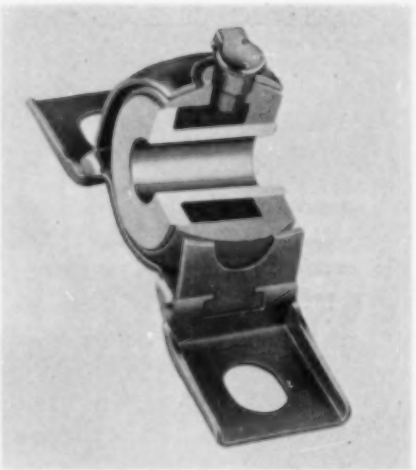


a snap-lock top with holes that permit mounting in any position with the cup always uppermost and a base that can be bolted or welded in place. The latter bearing is available in light- and heavy-duty models with bores from ½ inch to 1¼ inches; the flange type with bores from ½ to 1 inch.

Circle 6E on reply card

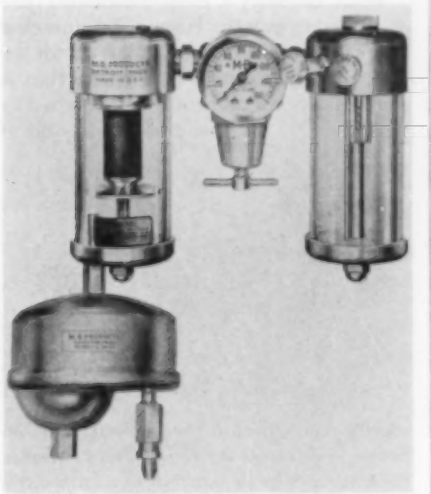
Construction of a rapid-transit railway system, partly underground and partly above, was started in Nagoya, Japan, in August. The plan calls for a 34-mile system to be built, in stages, over a period of 30 years. The first section, 1⅝ miles long, is expected to be in service in two years. Nagoya has a population of a little more than a million.

Granular material in slurry form can be easily dewatered, it is claimed, by an automatic pressure filter designed by The Hydro-Blast Corporation. Originally designed for washing and reclaiming foundry sand, the material flows into a vertical tank through an air-controlled feed valve which closes when the slurry reaches a predetermined level. Then a solenoid-operated timer comes into action to open the main valve which admits air at 85-100 psi pressure into the

filter. This forces the liquid down and out through a screened bottom door into a drain while the solids, after dewatering, enter a receiving hopper, a blast of compressed air exerted on top of the mass making sure of complete discharge. The door is actuated by a pneumatic cylinder controlled by a timer and is prevented from opening while the unit is under pressure by a pressure switch. The operating cycle varies with the material. It is reported that a tank 14 inches in diameter and 6 feet 3 inches high has a maximum capacity of 5 tons of sand per hour when handling slurry that is 70 percent solids and weighs 100 pounds per cubic foot.

Circle 7E on reply card

An automatic water ejector for air-line service that weighs less than 5 pounds has been announced by M-B Products. The trap features a standpipe or water leg that extends to a point between the filter element and the bottom of the bowl and increases the efficiency of the

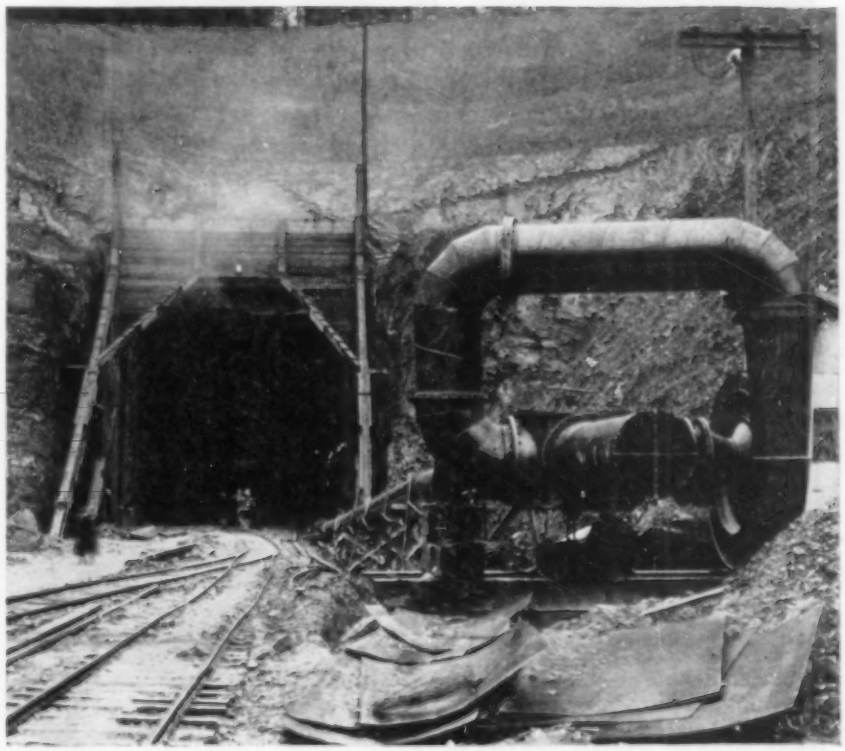


separator without danger of water carry over. Accumulations of 3-4 ounces are ejected in less than five seconds, and pipe scale and other solids are trapped in the bowl. They are easily removed and cannot enter the trap to cause clogging or other damage. The unit has a capacity of 20 gallons per hour and is said to insure a steady flow of dry air regardless of atmospheric conditions.

Circle 8E on reply card

An improved plug-type valve for pneumatic applications, fluid transmission systems, instrumentation and similar uses has been announced by The Imperial Brass Manufacturing Company. Recommended for working pressures up to 300 psi, it features a plug that is kept under constant line pressure to prevent it from lifting and a floating stem that is sealed against leakage by an "0" ring and that has a retaining shoulder to hold it in place. Designated as the 200 Series, the valve is available in ⅛-, ¼-

GOES IN FRESH ...COMES OUT STALE



You can't get far in tunnel construction without dependable lines to push in fresh air and pull out fumes, gases, dusts and stale air. That's why Naylor pipe has become a stand-by for contractors in providing the "wind pipes" vital to this service. Its light-weight makes Naylor easy to install — easy to extend as work progresses, particularly with the Naylor one-piece Wedge-Lock coupling to speed connections. For air lines or water lines, you can depend on Naylor for the pipe to meet your requirements. Write for Bulletins No. 507 and No. 514.

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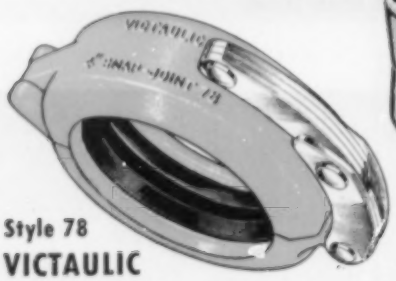
VICTAULIC METHOD OF PIPING

FOR GROOVED PIPE



Style 78

VICTAULIC SNAP-JOINT

New, boltless coupling — hand-locks — for faster hook-ups with no loose parts. Ideal for temporary or permanent lines. Sizes 1", 1¼", 2", 3", 4".

Style 77 & 77-D

VICTAULIC COUPLINGS Style 75

Style 77 & 77-D—The "general-purpose" couplings for standard applications. Simple, fast, reliable—sizes ¾" to 60".

Style 75—Light Weight Couplings—for low pressure, low external stress applications. Sizes 2", 3", 4".

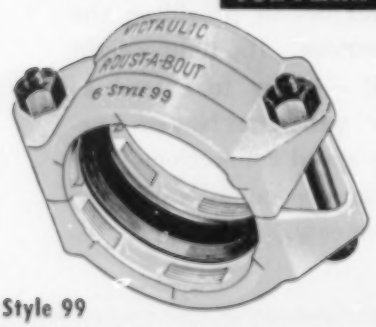
VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the work in half the time. Light weight, easy to handle, operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".

VICTAULIC FULL-FLOW FITTINGS

Streamlined for top efficiency, easy to install—complete line, Elbows, Tees, Reducers, Laterals, etc., — fit all Victaulic Couplings. Sizes ¾" to 12".

FOR PLAIN END PIPE



Style 99

VICTAULIC ROUST-A-BOUT COUPLINGS Best engineered, most useful plain end joint on the market! Simple, fast, husky. Easy to install with any socket wrench. Takes strong, positive, bull-dog grip on pipe. Sizes 2" to 8".

Promptly available from distributor stocks coast-to-coast. Write for NEW Victaulic Catalog and Engineering Manual No. 54-8B

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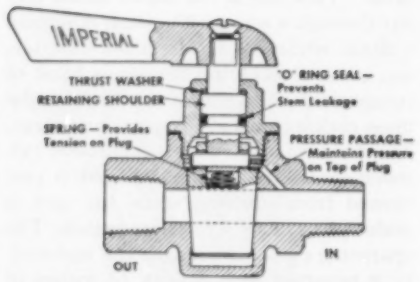
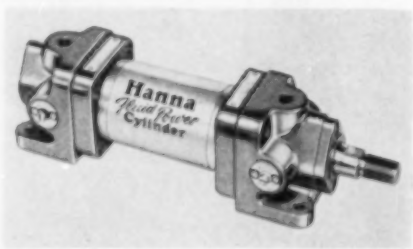


and ⅜-inch pipe-thread sizes and provides passage equivalent to the inside diameter of the pipe connection. Positive stop insures full opening.

Circle 9E on reply card

A Swedish iron mine at Kiruna, Lapland, has ordered what is reputed to be the largest rock crusher yet built. Weighing 116 tons, it has an intake opening of 55x71 inches and will handle chunks weighing up to 10 tons each. It will be installed underground.

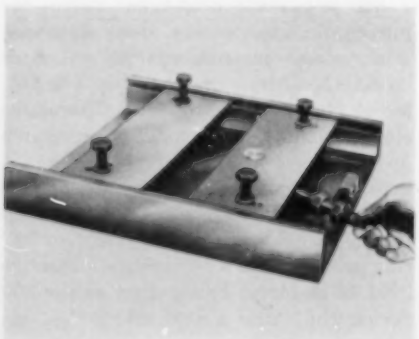
With industry's ever-broadening use of cylinder power, Hanna Engineering Works has introduced a line of air or hydraulic cylinders of new design that is said to have an unusually large capacity to size ratio. Corrosion resistant and of



sturdy construction throughout, the 750 Series is grooved for block Vee synthetic packing to reduce friction to a minimum consistent with positive sealing, incorporates an easily adjustable cushion that allows immediate full flow on the return stroke, and has a self-locking piston-rod nut to prevent loosening under vibration.

Circle 10E on reply card

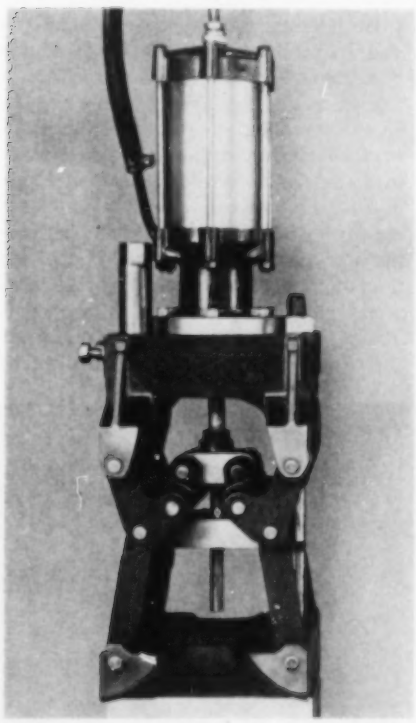
In the case of wide-range, variable-pitch sheave installations it is necessary to make provision for more take-up than with standard V-drives because center distance adjustment is needed for belt stretch and changes in pitch diameter.



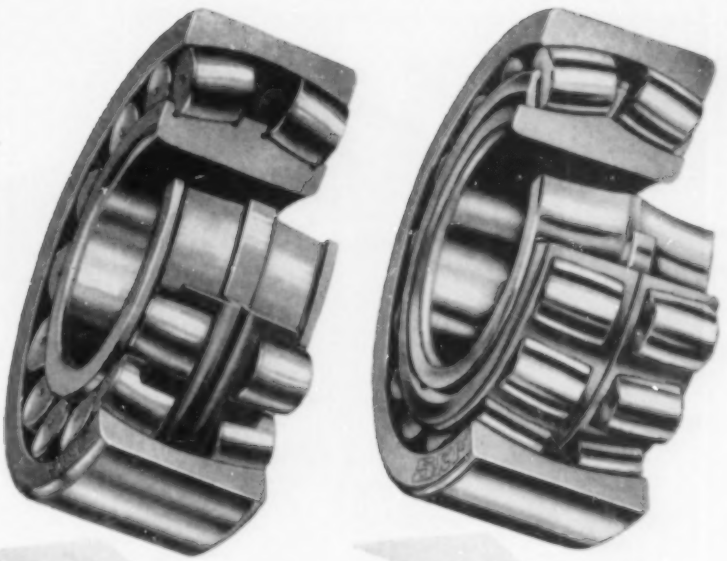
To simplify and speed up the operation, T. B. Wood's Sons Company has designed and is manufacturing a Quick-Slide motor base. As the name implies, it permits moving the motor freely and quickly after the base is bolted down by releasing an adjusting screw, as the accompanying illustration shows.

Circle 11E on reply card

Interchangeable die units and an impact-type pneumatic cylinder are features of a die-casting machine made especially for manufacturers producing small quantities of zinc castings weighing less than a pound. The Imp/96 offered by DCMT Sales Corporation is powered entirely by air at 80-100 psi pressure and is designed for high-speed injection. It applies full air-line pressure to the main cylinder by operating its built-in valve through the medium of a



much smaller pilot valve consisting of a pneumatic cylinder, an arrangement that eliminates intervening restrictions or small ports with their throttling effect. In addition, the piston of the injection cylinder is oversize in relation to the latter (3-inch to 4-inch diameter, respectively) to prevent the formation of an air cushion beneath it on the down stroke and thus to exert maximum pressure against the molten metal so as to fill the die cavity quickly. The result is said to be a dense casting with a good surface finish. As a safety measure the entire pneumatic system is interlocked to obviate injection so long as the dies are open. The die unit is removed from the machine by uncoupling two hose lines and by backing off two nuts. By using a standby with a die mounted on it, changeover from one job to another



Which bearing has more capacity?

The one on the right has. Up to 50% More in Fact

It's an exclusive SKF advance in bearing design, the Type "C" Spherical Roller Bearing, which—within the same boundary dimensions—provides this greatly increased capacity, and an increase in service life of 2 to 3½ times.

Have you an application where you could use a spherical roller bearing of the same size, but with more capacity and longer life . . . and *with no increase in cost?*

Or, for new designs, would you like to take advantage of the Type "C's" increased capacity by using smaller bearings—to make your products lighter . . . smaller . . . less expensive?

Why not get the full details? First, write for SKF Bulletin 365X, which gives complete information on the sizes available. Second, pass this bulletin on to your designers with the suggestion that they talk it over with an SKF Field Engineer.

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.—*manufacturers of* **SKF** *and* HESS-BRIGHT® *bearings.* 7552

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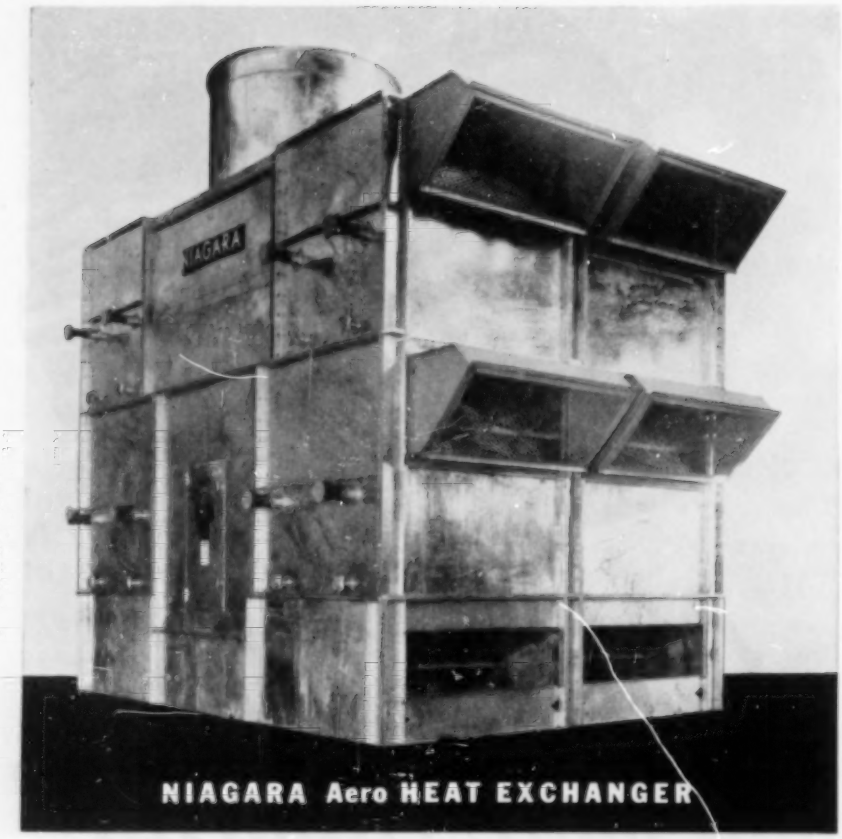
SKF®
BALL AND ROLLER BEARINGS

Circle 22A on reply card



NIAGARA Aero HEAT EXCHANGER

Thirty Million B.T.U. CAPACITY

with Precise Control of Temperature in Cooling

The NIAGARA Aero HEAT EXCHANGER cools liquids and gases by evaporative cooling with atmospheric air, removing the heat at the rate of input, controlling temperature precisely. You save 95% of cost of cooling water; you make great savings in pumping, piping, power; quickly recover your installation cost.

You can cool and hold accurately the temperature of all fluids, air and gases, water, oils, solutions, chemical intermediates, coolants for mechanical, electrical and thermal processes. You obtain closed system cooling free from dirt. You solve all the problems of water availability, quality or temperature.

In CHEMICAL PROCESSES this is successfully used in cooling liquids and gases, chemical reactions, condensing distillations and reflux cooling.

Write for complete information; ask for Bulletins 120 and 124. Address Dept. CA.

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N.Y.

District Engineers in Principal Cities of United States and Canada

Circle 23A on reply card

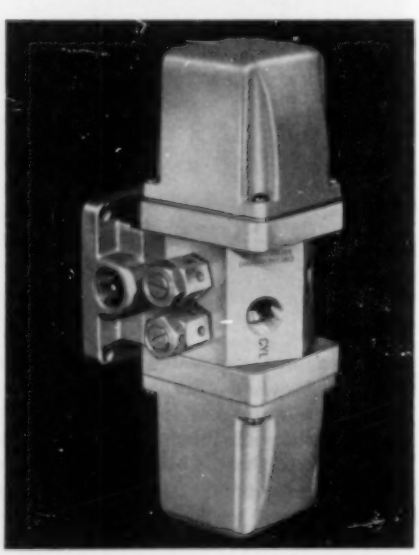
can be effected in a minute or two, it is claimed, cutting the cost of downtime for any purpose to a minimum.

Circle 12E on reply card

New double-cavity glass blocks for exterior walls and roofs have been introduced by Pittsburgh Corning Corporation under the name of Suntrol. They feature light-control prisms on the inner surfaces that send the rays where they are desired and a pale-green fibrous glass diffusing screen which is sealed lengthwise in the center of the block to form two chambers. These are under a partial vacuum which is said to keep out much of the sun's heat, while the screen provides a soothing glow that, according to research conducted by the company, makes workers feel cooler and more relaxed regardless of the temperature.

Circle 13E on reply card

Both single and double solenoid air and hydraulic valves of the Hi-Cyclic type manufactured by Beckett-Harcum Company are now available in a new design that embodies a number of improvements including nylon end-thrust bushings for positive valve-piston location; dust- and moisture-proof solenoid enclosure; quick-disconnect electrical connections that permit removal of the solenoid coil without disturbing the electrical circuit; valve part interchangeability; and elimination of solenoid adjustment. There is no metal-to-metal



contact between the solenoid and valve piston; and Hycar bumper mountings, together with the nylon bushings and actuating pins, prevent transmitting shock to the valve body. All electrical leads are channeled from one ½-inch conduit at the base of the valve. The units can be mounted in any position and are made with ¼-, ⅜- and ½-inch ports for air and ⅜-inch ports for hydraulic fluids.

Circle 14E on reply card

Books and Industrial Literature

Steam, Air, and Gas Power by William H. Severns, Howard E. Degler and John C. Miles is now available in a completely revised Fifth Edition. A textbook for basic courses in heat-power theory, practice and equipment, it is much broader in scope than the earlier works. The introductory chapters on heat-power terminology and arrangements of modern plants have been enlarged; the fundamentals of thermodynamics and liquid and gaseous fuels are covered more fully; the sections dealing with steam generators and their auxiliaries, steam turbines, steam condensers and pumps have been brought up to date; centrifugal and axial-flow compressors are included in the discussion of air and gas compression; and the material on internal-combustion engines is presented with emphasis on theory and operation rather than description. In addition, there are entirely new chapters on mechanical refrigeration and gas turbines and many new diagrams, illustrations, examples and problems with answers in numerous cases. Publisher John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y. Price $6.50.

High-speed surface broaching with Colonial Broach Company's new mechanical horizontals is the subject of Bulletin No. HM-54 released by the firm.

Circle 15E on reply card

Niagara Blower Company's Aeropass for large-scale cooling and condensing services is described and illustrated in Bulletin 123 obtainable upon request.

Circle 16E on reply card

Folder No. 73 issued by Wilder Manufacturing Company, Inc., shows its complete No. 700 line of platform, bin, table, shelf and box trucks designed to meet all needs in the medium-handling field.

Circle 17E on reply card

Air-powered vises of the Vi Speed type and time savings effected by them in manifold industrial holding jobs are dealt with in an illustrated brochure being distributed by Van Products Company.

Circle 18E on reply card

A 16-page brochure prepared by Goshen Rubber Company, Inc., lists its line of standard and special-size grommets available in a wide range of natural-, synthetic-, and silicone-rubber compounds.

Circle 19E on reply card

Air release valves made by The V.D. Anderson Company for a wide range of services are covered in a recently released bulletin, No. 654. Included among other data is a table showing the cubic feet of free air handled by the traps at different operating pressures.

Circle 20E on reply card

Minneapolis-Honeywell Regulator Company has revised its No. 10.15-7a Data Sheet which describes Mine Safety Appliances Company's carbon-monoxide system which uses a Brown ElectroniK potentiometer to record and/or control hazardous concentrations of the gas.

Circle 21E on reply card

Users of circulating and coolant pumps may be interested in a new bulletin (Form 7074-D) on Ingersoll-Rand Company's entire line of KRV and KRVS Motorpumps. These units are especially suitable for use on

CONTINENTAL RED SEAL®

means more and better power

JAEGER MODEL 4½HM-D Mixer. Capacity 4½ cu. yd. Powered by Continental Red Seal F-6226 engine.

NO OTHER ENGINE GIVES YOU ALL THESE ADVANCED ENGINEERING FEATURES

PATENTED INDIVIDUAL PORTING
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FULL-LENGTH WATER JACKETS
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•
LEAKPROOF WATER PUMP
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ALLOY STEEL VALVE SEAT INSERTS
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POSITIVE ROTATION EXHAUST VALVES
•

Continental Red Seal power for specialized applications is now available at levels ranging from 2 h.p. up to more than 1,000, in liquid-cooled and air-cooled models, for use on all standard fuels. And, strictly on the score of PERFORMANCE—economy, dependability and low maintenance cost—it is finding its way into more and more leading makes of specialized machines. The equipment builder's good name, and the end-user's satisfaction, are double-clinched by this fact: EVERY CONTINENTAL RED SEAL IS NOT ONLY BUILT FOR ITS JOB, BUT BACKED BY PARTS AND SERVICE FACILITIES COAST TO COAST.

•

A COMPLETE LINE OF 4-CYCLE AIR-COOLED ENGINES

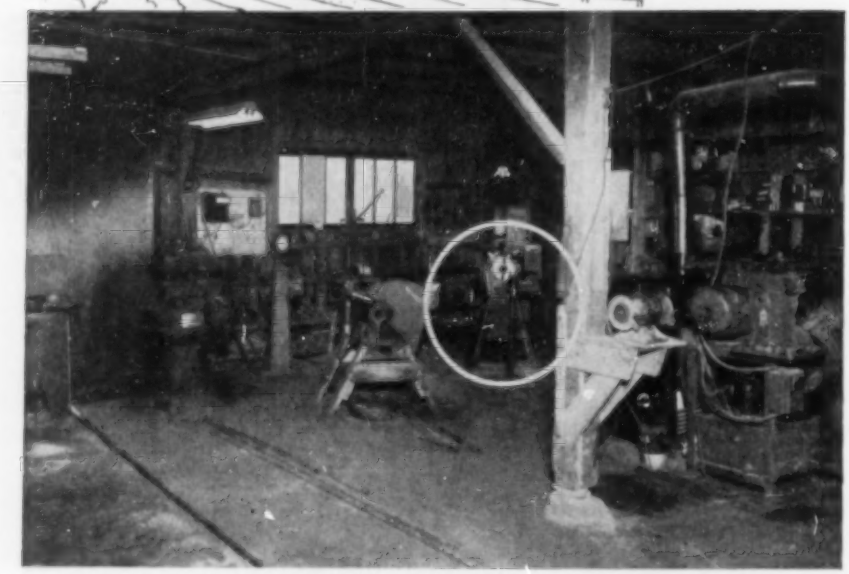
Continental also builds air-cooled models, from 2 to 3 h.p., for heavy-duty applications in industry and on the farm. They embody the exclusive Contex® external ignition system, greatest air-cooled engine advance in recent years. For information, address Air-Cooled Industrial Engine Division, 12800 Kercheval Ave., Detroit 15.

6 EAST 45TH ST., NEW YORK 17, N. Y. • 6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF. • 910 S. BOSTON ST., ROOM 1008, TULSA, OKLA. • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.

Continental Motors Corporation
MUSKEGON, MICHIGAN

Circle 22A on reply card

on the NEW YORK THRUWAY...



Savin Construction Corp. threads Drill Steel on the job with

Toledo Rock Drill Rod Machine

After rod is annealed, Toledo Machine will turn to size, thread and face off end of rod to a perfect fit for detachable bits.

TOLEDO
ROCK DRILL ROD MACHINE

This TOLEDO Machine was used for rethreading 1¼" drill steel in Savin Construction Corp.'s blacksmith shop on the New York Thruway contract south of Albany. Approximately 50 steels per day were rethreaded varying in length from 4 feet to 30 feet. This shop was established in farm outbuildings on the right-of-way at a point about midway on the 22-mile long contract. Total rock yardage on this contract was approx. 2,000,000 cyds.

You can thread new or rethread a broken drill rod at a fraction of the cost of a new rod with this Toledo Machine. Reduces downtime. Can be tooled to produce Ingersoll-Rand and Timken threads that fit detachable bits perfectly. Used in conversion shops throughout the country. Write for catalog.

Builders of World's Finest **TOLEDO**

PIPE TOOLS . . .
PIPE WRENCHES . . .
POWER DRIVES . . .
POWER PIPE MACHINES

TOLEDO PIPE THREADING MACHINE CO., Toledo, Ohio

Circle 25A on reply card

machine tools and on washing, cleaning, water-conditioning, bakery and dairy machinery. Descriptions of the various classes are accompanied by cross-sectional drawings and performance curves, and an index makes for easy reference.

Circle 22E on reply card

Garonite, a fast-setting cement for anchoring any type of machinery or concrete installation, as well as patching concrete floors, is described in a bulletin prepared by The Garon Products Company.

Circle 23E on reply card

Philadelphia Gear Works has announced a 21-page catalogue, L-54, describing and illustrating its LimiTorque which controls valves automatically and limits the amount of torque applied to their operating parts.

Circle 24E on reply card

Readers may obtain from Mine Safety Appliances Company copies of Booklet No. 5000-4, *Disaster*, that is meant to assist industries having plant rescue teams choose suitable safety and rescue equipment.

Circle 25E on reply card

Morse Chain Company's complete line of mechanical power-transmission products is described in a revised catalogue, B20-53. New information on Taper-Lock sprockets, cam clutches and torque-limiting clutches is included.

Circle 26E on reply card

Michigan Tool Company has ready for distribution a 12-page bulletin, No. 1800-54, which summarizes its Shear-Speed shaper line. The process for cutting one or several gears, splines, cams, sprockets and miscellaneous shapes is fully outlined, and information on tooling, feeds, etc., is included.

Circle 27E on reply card

Catalogue No. 53 issued by Kunkle Valve Company provides selection and capacity data for air, gas, steam and liquid safety and relief valves serving as components of units involving pneumatics or hydraulics. The valves come in a wide range of types and sizes in bronze, iron, steel and alloys.

Circle 28E on reply card

A new 340-page standard products catalogue, No. 950, arranged for easy and rapid selection of chains and sprockets for conveying, elevating and power transmission, as well as of numerous other items, has been published by Link-Belt Company. It should be of value to engineers and layout men.

Circle 29E on reply card

The principal beryllium-copper alloys are dealt with in a 4-page folder offered by the Industrial Division of American Silver Company, Inc. In addition to charts and graphs on engineering properties and tempers, it tells how to heat-treat these alloys and gives basic information for those who have never worked with them.

Circle 30E on reply card

Literature on Allegheny Ludlum Steel Corporation's new hot-extruded shapes of high-temperature alloys and stainless, tool and other steels is now available. It describes the process, points out the advantages of shapes made by it, and illustrates some of the parts produced in small or large tonnages.

Circle 31E on reply card

Have You Checked Your Steam Costs Lately? is the title of a picture book obtainable from Orr & Sembower, Inc., manufacturer of Powermaster packaged, automatic boilers. Cartoons with serious captions

serve to point out typical plant problems and the high cost of operation with obsolescent equipment. Different Powermaster installations are illustrated and described.

Circle 32E on reply card

The pneumatic handling of dry, pulverized or granular materials is discussed in a 16-page bulletin, G-2, released by the Fuller Company and entitled *How to Pipe Dollars Out of Thin Air*. It includes a list of 86 such materials and indicates which of its three systems—Airveyor, Airslide and Fuller-Kinyon—should be used in each case. Also covered are the Fuller clinker cooler and its new kiln preheater.

Circle 33E on reply card

Power Spray Washers is the title of Technical Bulletin No. 301 obtainable from Peters-Dalton, Inc. In addition to discussing the various types, layouts and applications, the 16-page booklet includes engineering drawings showing the essential features of the machines in most common use for cleaning or surface treating parts with liquid chemicals.

Circle 34E on reply card

With the specifier and buyer of piping equipment in mind, Crane Company has issued a 20-page illustrated pamphlet entitled *Choosing the Right Valve*. It is intended to serve as a refresher course in gate, globe and check valves—the three basic designs—and their applications and contains all the information necessary to pick the one that will best meet each service requirement.

Circle 35E on reply card

Everything for the welder is dealt with in a 52-page products catalogue—ADC 662B—offered by Air Reduction Sales Company. It tells how each item operates and for what purpose it is intended and also calls attention to three of its latest developments—Aircospot or inert-gas spotwelding, Easyarc 12 electrode and heavy-duty cutting attachments for torches.

Circle 36E on reply card

Miller Fluid Power Company has prepared a pamphlet, entitled *A Cylinder Program for Automation and Heavy Duty Service*, that indicates a trend among manufacturers towards the standardization of air and hydraulic cylinders and points out the advantages of interchangeability in whole or in part. It contains much useful information about its own high-pressure cylinders, including a table that gives internal fluid pressure stresses of essential components.

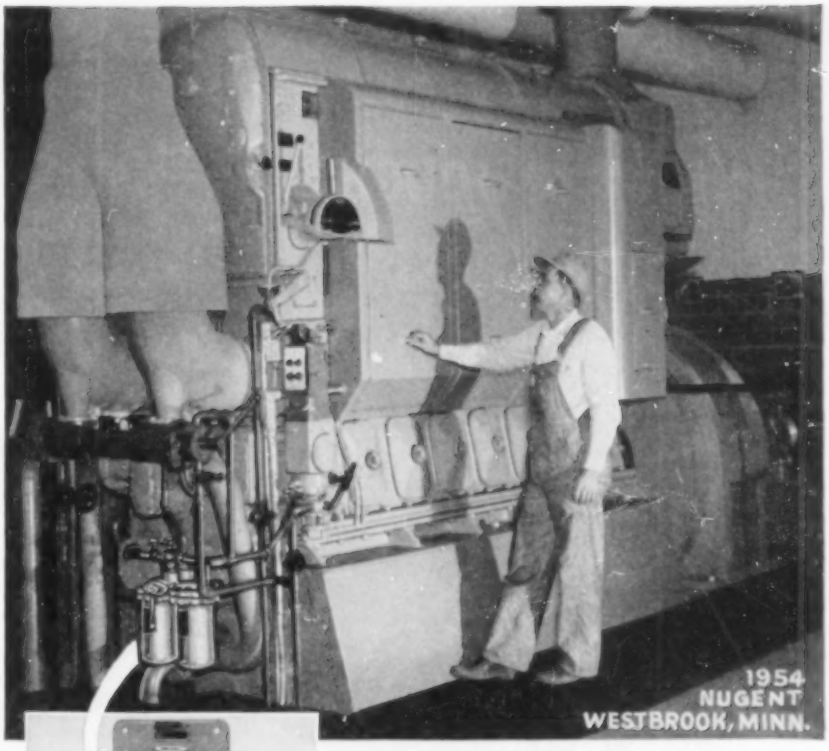
Circle 37E on reply card

Brown Engineering Company is offering Bulletin 28 which illustrates and describes its Kushion-Torq shaft couplings rated from ¾ to 1500 hp. Listed are available sizes with dimensions, weights and safety factors for use with various types of equipment. Of the leaf-spring cantilever type they are designed to cushion driving and driven equipment subjected to shock loads, to compensate for misalignment of shafts and to reduce radial and torsional vibration.

Circle 38E on reply card

How "dag" colloidal dispersions serve industry is told in Bulletin No. 460 published by Acheson Colloids Company, Division of Acheson Industries, Inc. Developed in 1906 to provide a lubricant in liquid form, colloidal graphite is now available in close to 50 dispersions. Listed are 40 basic dispersions with the comparative particle size and consistency of each. Information on dilution and typical applications are also given.

Circle 39E on reply card



NEW

Power Plant Diesel protected by Nugent Fuel Oil Filters

A power plant can't afford "second best" when it comes to diesel fuel oil filters. *That's why* leading diesel manufacturers install Nugent Fuel Oil Filters on nearly every engine slated for power plant service. *That's why* a Nugent Duplex Fuel Oil Filter was included as original equipment on the 960 HP Fairbanks Morse recently installed for municipal power service at Westbrook, Minnesota.

Nugent Duplex Fuel Oil Filters of this type utilize an inexpensive bag type cartridge that actually removes 99.8% of all solid foreign material from the fuel oil. The cartridge lasts a long time, is easy to replace and presents 20 times more filtering area than any other charge of comparable size. The filter covers, valve manifold and bracket is one casting. Units can be operated separately or in parallel and slow manipulation of the valves will not cause stoppage or high pressure.

You, too, can't afford "second best" when it comes to fuel or lube oil filtering. So, take a tip from leading diesel manufacturers and investigate the possibilities of Nugent Filtering units for your own equipment.

NUGENT TRADE MARK

Wm. W. Nugent & Co., Inc.

422 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS. OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

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Circle 26A on reply card

Use This Hose...
FOR YOUR TOUGHEST DRILLING JOBS!

"HARDROK"
Wire Braid AIR HOSE

Assurance of longer service life, with consequently lower replacement costs, recommends "HARDROK" wherever severest drilling conditions call for a truly **super-strong** air hose.

The carcass is made of horizontally braided steel wires, providing exceptional strength, durability and resistance to kinking, without impairing flexibility. The long-lasting Synplastic tube is impervious to the action of oil from the drill. The cover is a tough, wear-resistant yellow rubber compound. A black spiral stripe gives the hose a distinctive appearance for easy identification. Sizes ½" to 2", inclusive.

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Est. 1870

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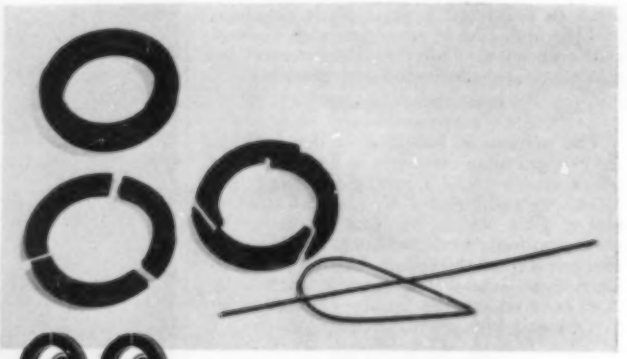

Look to COOK for Better PACKING RINGS!

Whatever your packing-ring requirements, you can depend on Cook for a ring *design* and ring *material* that will deliver maximum efficiency at minimum cost.

One *source*, one high standard of *quality* — that's what you get when you specify Cook — packing-ring pioneers since 1888. Write direct for complete technical data. C. Lee Cook Manufacturing Co., 930 So. 8th St., Louisville 8, Ky.

MATERIALS

GRAPHITIC IRON
(Exclusive with Cook)

COOKMET
(No. 1—Plastic Bronze)
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(Highly Anti-Frictional)

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(For Non-Lubricated Service)

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Sealing Pressures Since 1888

Circle 28A on reply card

LOGAN AIR AND HYDRAULIC POWER

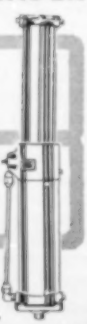
SPEEDS • COORDINATES • REFINES PRODUCTION
IN OVER 10,000 INDUSTRIAL PLANTS

AIR-DRAULIC CYLINDERS • AIR and HYDRAULIC PRESSES • COLLET GRIP TUBE FITTINGS • SUMP PUMPS • SURE-FLOW COOLANT PUMPS • HYDRAULIC POWER UNITS • HYDRAULIC CYLINDERS • HYDRAULIC CONTROL VALVES • AIR CHUCKS • AIR CONTROL VALVES • AIR CYLINDERS • AIR-DRAULIC CYLINDERS

Logan

AIR-DRAULIC® FEED-CONTROLLED **CYLINDERS**

COMBINES
the fast-acting, economical low-pressure operation of
AIR
with the smooth, uniform controlled regulation of
OIL



5 STANDARD MOUNTING TYPES
Standard bores from 3" to 8". Standard strokes to 5'.

SAVES TIME Logan AIR AND HYDRAULIC EQUIPMENT EXPORT-MOTION

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS • CATALOG ON REQUEST

Let Logan Engineers help you design your Air and Hydraulic Circuits.

LOGANSPORT MACHINE CO., INC.
846 Center Avenue Logansport, Indiana

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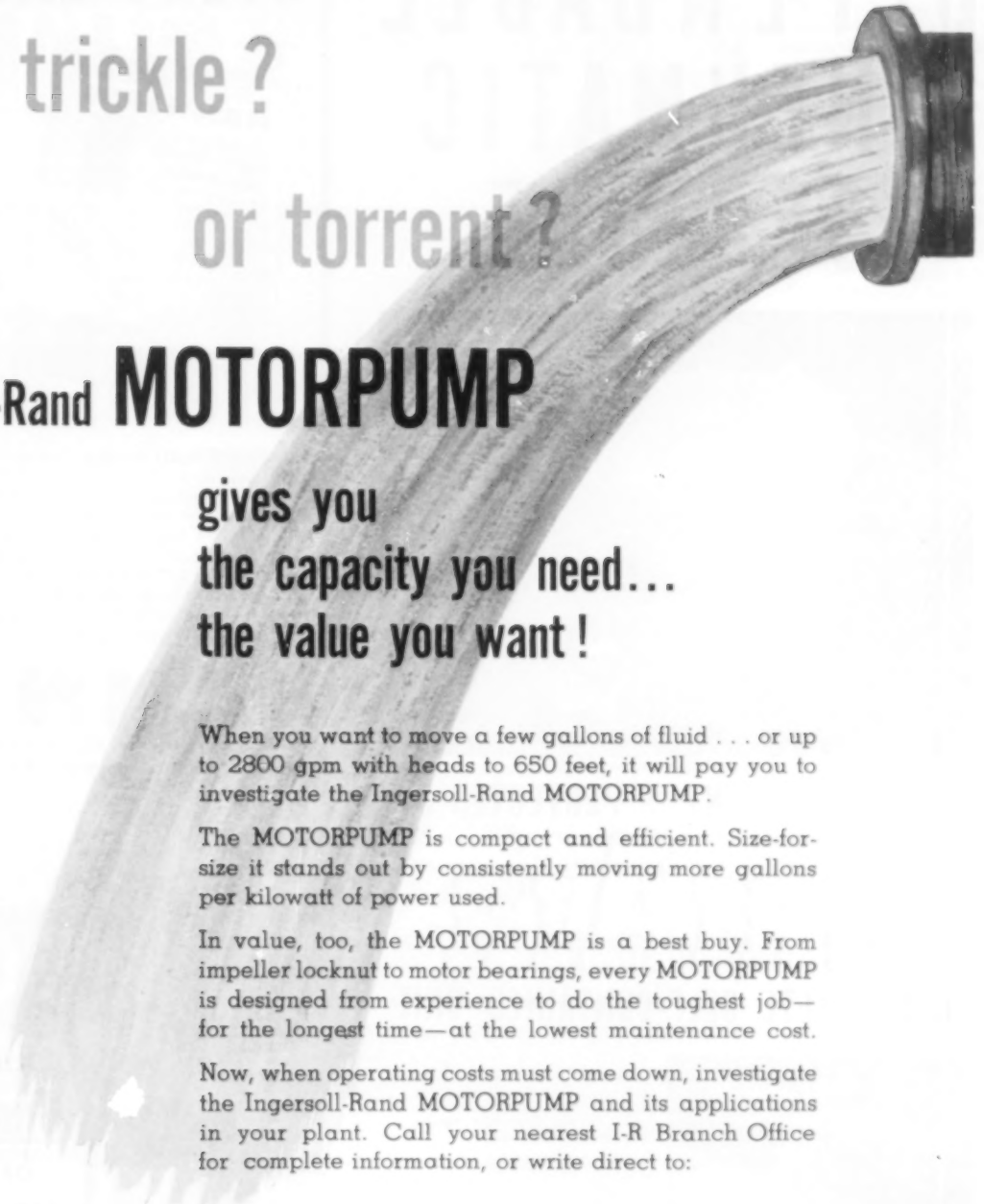
trickle?

or torrent?



the Ingersoll-Rand MOTORPUMP

gives you the capacity you need... the value you want!

When you want to move a few gallons of fluid . . . or up to 2800 gpm with heads to 650 feet, it will pay you to investigate the Ingersoll-Rand MOTORPUMP.

The MOTORPUMP is compact and efficient. Size-for-size it stands out by consistently moving more gallons per kilowatt of power used.

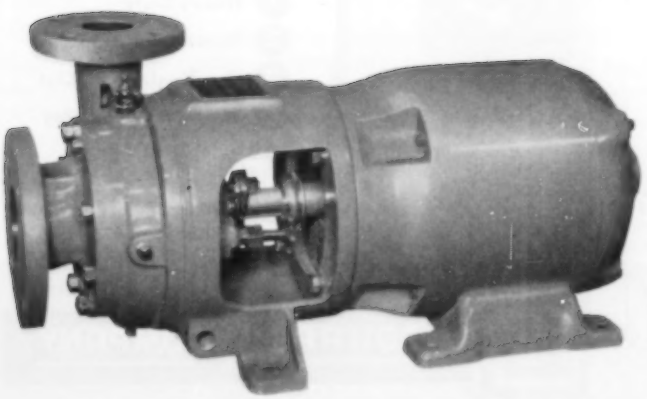
In value, too, the MOTORPUMP is a best buy. From impeller locknut to motor bearings, every MOTORPUMP is designed from experience to do the toughest job—for the longest time—at the lowest maintenance cost.

Now, when operating costs must come down, investigate the Ingersoll-Rand MOTORPUMP and its applications in your plant. Call your nearest I-R Branch Office for complete information, or write direct to:

Ingersoll-Rand

CAMERON PUMP DIVISION

11 BROADWAY, NEW YORK 4, N.Y.



MOTORPUMP

• End-to-end, top-to-bottom, the MOTORPUMP is crammed with design features and construction advantages that make it a better buy.

9-107A

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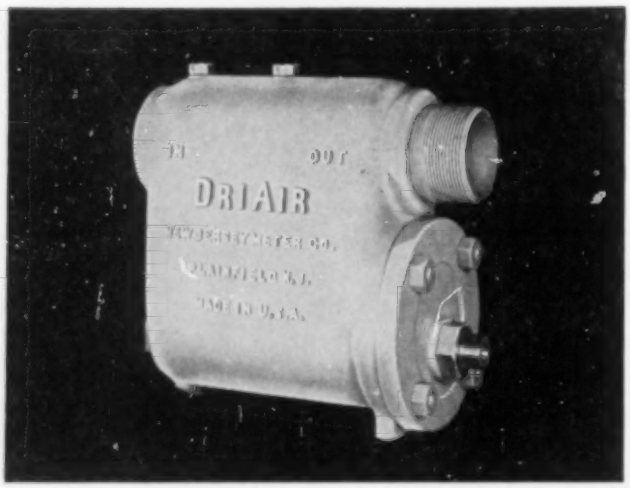
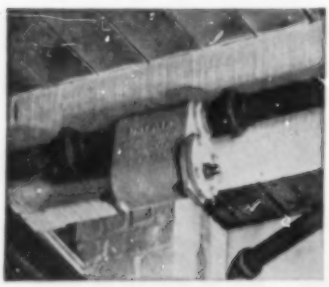
DEPENDABLE PNEUMATIC SERVICE



WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

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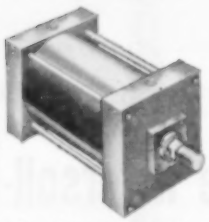
EVERY ENGINEER

will want a copy of this BULLETIN



WRITE FOR BULLETIN 213. Complete details and mounting dimensions on Hannifin Series "A" Square Type Fluid Power Cylinders, usable up to 200 psi, air or oil. This is the cylinder with the new, externally removable cartridge gland...the biggest improvement in cylinder design in the last 50 years. The "A" line is complete! 11 bore sizes from 1½" to 14"—13 standard mountings, many combinations. Steel heads. Brass bodies. Piston rods ground, polished and hard chrome plated. Send for Bulletin 213. It's the easiest catalog to use in the cylinder business.

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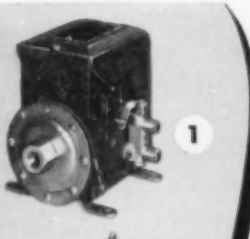

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FOR A

Complete Line

OF H.P. RATED

AIR COMPRESSOR SWITCHES

1. Heavy Duty
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3. Gas Engine Cut-Out
4. Magnetic Unloader

all with or without Release Valves

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ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

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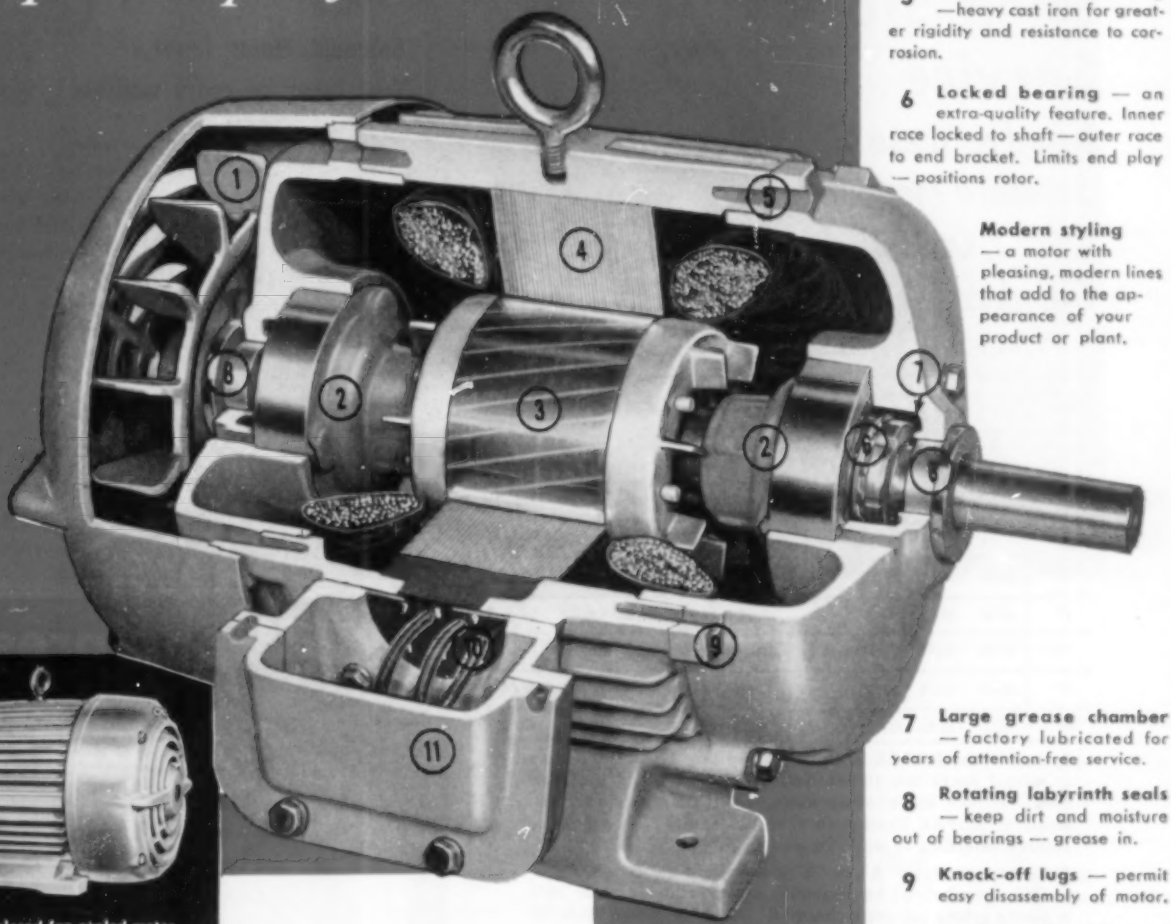
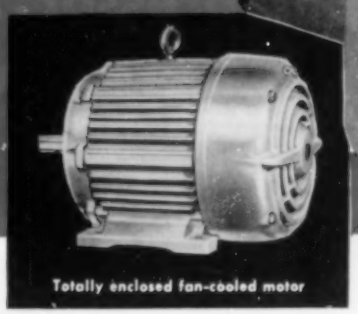
Here's the inside story of

the NEW L.A. *Line*

...your BEST enclosed and explosion-proof motor BUY



Cutaway view of explosion-proof motor



Totally enclosed fan-cooled motor

1 Fan — efficient, non-sparking fan. New aerodynamic design for more effective cooling.

2 Inner bearing cartridges — lock bearings to end bracket and form explosion-quenching seal along shaft.

3 Indestructable cast-aluminum rotor—dynamically balanced with fan for smooth, quiet operation.

4 Stator — prewound stator core utilizes Formvar wire insulated with a new Alkyd Asphalt Resin insulating varnish.

5 End bracket and housing —heavy cast iron for greater rigidity and resistance to corrosion.

6 Locked bearing — an extra-quality feature. Inner race locked to shaft — outer race to end bracket. Limits end play — positions rotor.

Modern styling — a motor with pleasing, modern lines that add to the appearance of your product or plant.

7 Large grease chamber — factory lubricated for years of attention-free service.

8 Rotating labyrinth seals — keep dirt and moisture out of bearings — grease in.

9 Knock-off lugs — permit easy disassembly of motor.

10 Lead identification—permanent, positive lead identification spacer in conduit box.

11 New split conduit box — rugged cast-iron conduit box diagonally split for easy connection.

This is the completely new L.A. totally enclosed fan-cooled and explosion-proof motor. Every feature in this new line is designed for easier installation, longer service life, less maintenance and attention. You get the full benefit of the new NEMA standards in a smaller, more functional, completely modern design.

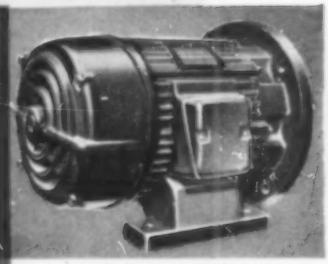
Your nearby Louis Allis Sales Engineer can show you all the reasons why these motors perform better and longer on your tough jobs — why they give you maximum resistance to corrosion wherever you need this extra protection. Call him today.

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

LA-103

Vertical NEMA D-flange motor

NEMA C-flange motor



NEMA D-flange motor

We specialize in SPECIAL MOTORS — *and* PROMPT DELIVERY, TOO

There's a Louis Allis special motor for your toughest application. Whatever electrical or mechanical modifications you need, check first with Louis Allis.

Now in its 6th year

NOPAK Shelf-Stock Service...

based on these 2 Standard Mounting, Class 1, Cushioned Cylinders

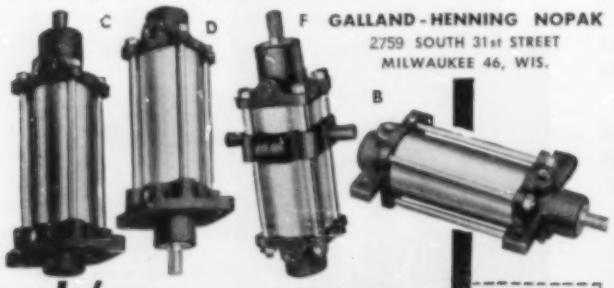
LIST PRICES F.O.B. Milwaukee, Wisconsin — Subject to Revision.

Cyl. Dia. Bore	STOCK STROKE LENGTHS — All Double Acting								
⟷	1"	2"	3"	4"	6"	8"	10"	12"	15"
1½"	24.16	25.72	26.08	26.44	27.16	27.88	28.60	29.32	30.40
2"	26.24	27.88	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	32.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
8"	.....	126.80	129.20	131.60	136.40	141.20	146.00	150.80	158.00

By specifying NOPAK Shelf-stock, you buy *quality cylinders* at lowest prevailing prices, you *eliminate waiting* for "specials", reduce engineering costs. Compare the prices and scope of NOPAK Shelf-stock (1½ x 1" to 8 x 15") with competitive offerings — and you *will specify* NOPAK.

● Basic mountings "A" or "E" convertible to "B", "C", "D" or "F", (see below) by changing cylinder heads. Add 10% to above prices (no extra charge 8" bore). ● Piston Rods NF male thread. ● Cushioning can be eliminated on rod, blank or both ends by removing spring and ball-check.

NOPAK 4-Way Valves, hand, foot, solenoid, or pilot operated, to actuate all cylinders, *also in Shelf-stock.*



GALLAND-HENNING NOPAK
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MILWAUKEE 46, WIS.

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

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A 8003-½-R

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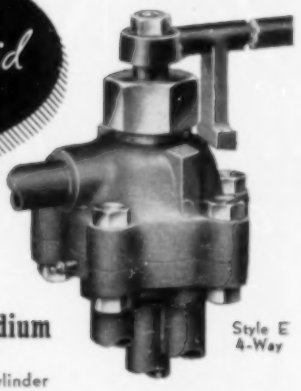
NICHOLSON

VALVES *for Air & Fluid Power*



Style E 4-Way

Solenoid, Motor, Lever, Foot types for every medium

Nicholson furnishes valves for cylinder control, distributing, metering and for many special operating cycles. Installations in a wide range of plants have been in constant service for well over 25 years. In addition to their long wear and minimum maintenance, Nicholson valves feature: specially treated hard seats and lapping flat discs which actually become tighter with use; choice of 6 metal combinations to suit your specific service; positive protection against grit. Sizes, ⅛" to 2½". Pressures up to 5000 lbs.

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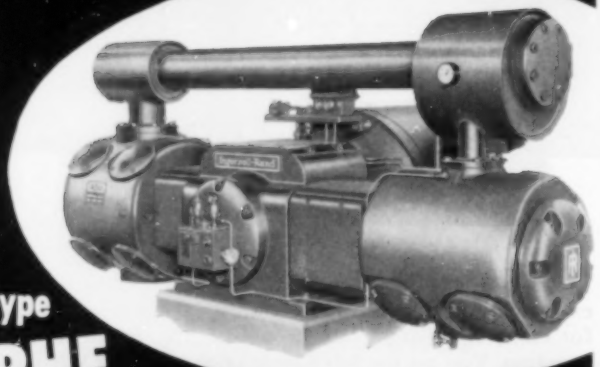

type PHE

Opposed-cylinder, Balanced design
75 and 100 Horsepower

Package unit . . . Compact, heavy-duty, water-cooled, easy to install . . . single- or multi-stage . . . compressor or vacuum pump.

PHE advanced-design features reduce overall cost of operation and provide a high degree of dependability. Send for Form 3155.

another achievement in electric-driven compressors

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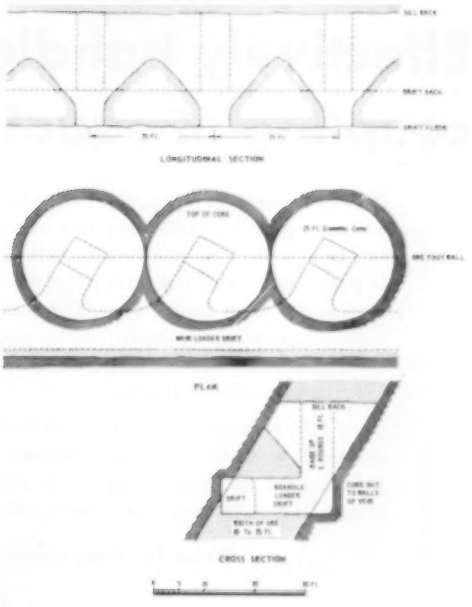
That's why so many mining men are traveling to see mines that have changed their systems to production loading with Eimcos.

Many different ideas for saving time and lowering costs have been developed by operators to fit their particular conditions. A sketch of one of these is at right. Eimco engineers have helped work out numerous systems, they will be glad to help you. Write Eimco for information.



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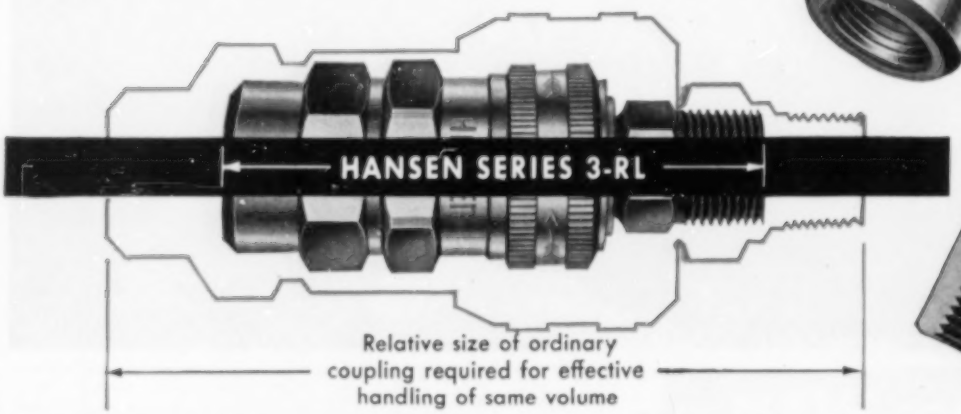
HANSEN

SERIES 3-RL

QUICK-CONNECTIVE

RING-LOCK COUPLING



Effectively handles far more volume than any coupling of equal dimensions

Tough, compact, smaller, the new Hansen Series 3-RL Coupling will handle any job in your shop using ¾" to ⅛" connections—from the air line to the air tool. No longer is there any need for various sizes of couplings at different points in your hook-up. The Hansen Series 3-RL, with completely interchangeable sockets and plugs does it all—makes it easy to keep stock of parts in balance—holds inventories to a minimum.

Carefully designed, the Hansen Series 3-RL combines maximum flow with compact construction. Sockets are brass with steel sleeves—plugs are steel. Sockets for use with small hand-operated air tools are available in aluminum.

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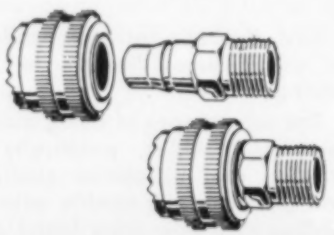

POSITIVE LOCKING

Ring Lock Provides Practically 360° Metal to Metal Contact

• Equipped with automatic sleeve lock, the Hansen Series 3-RL Coupling is quickly and positively connected merely by pushing plug into socket. To disconnect, just turn the sleeve. Locking ring in socket is forced into groove in plug, provides practically 360° metal to metal contact, reduces wear, and insures tight fit.

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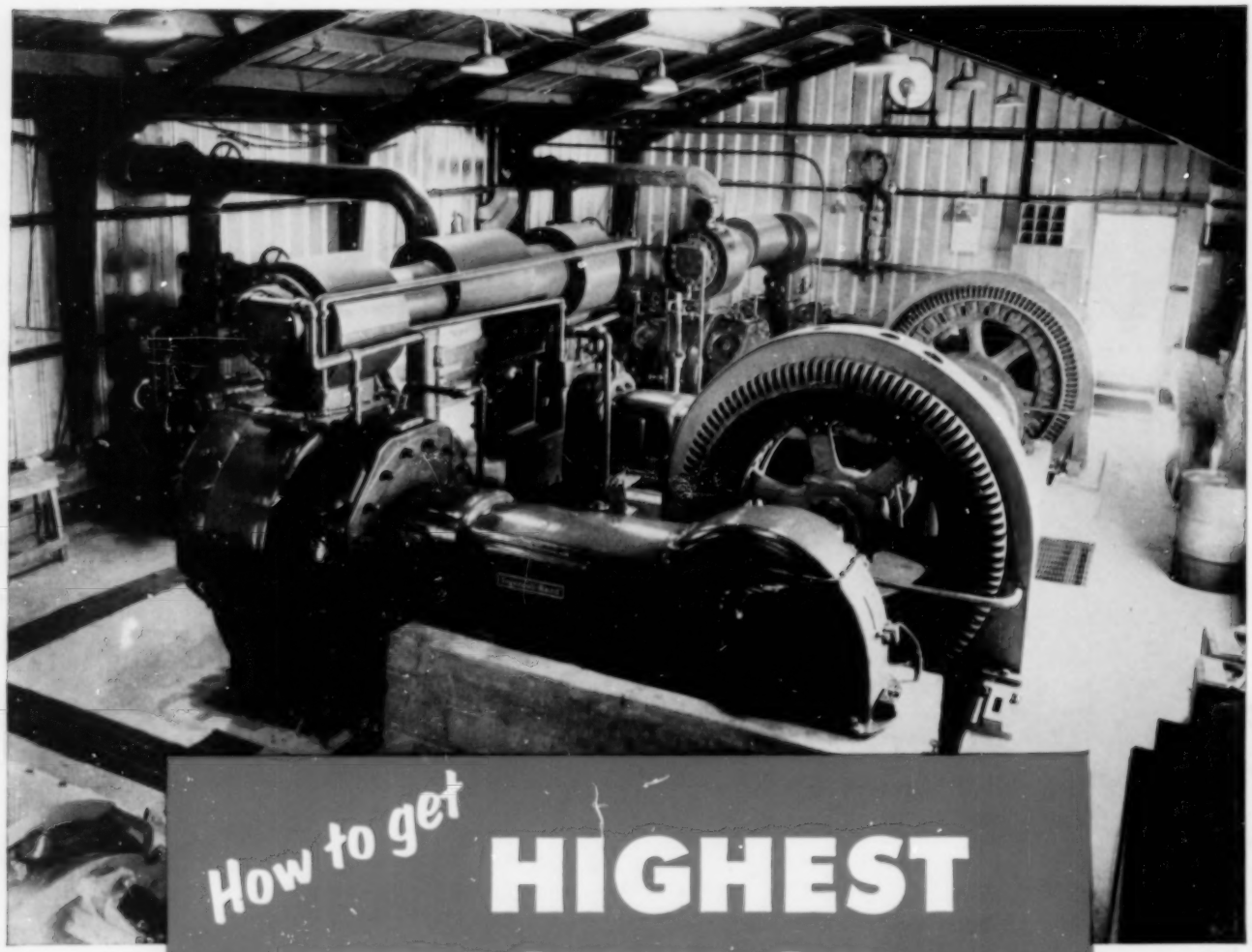

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